DANGERS TO HEALTH.

A PICTORIAL GUIDE TO SANITARY DEFECTS

T. PRIDGIN TEALE, M. A.

DANGERS TO HEALTH.

"In matters of prevention knowledge is power."

Dr. BURDON SANDERSON.

Harveian Oration.

"A few scratches with a pen are better than whole pages of the most elaborate description." Mrs. JAMESON.

Legends of the Madonna.

"Seguius irritant animos demissa per aurem
"Quam quæ sunt oculis subjecta fidelibus."

Hor. Epist. ad Pisones. l. 180.

"Things by the ear received, men's minds excite
"Much less than when submitted to the sight;
"For the spectator with his trusty eyes,
"To his own mind impressions best applies."

Translation by ANDREW WOOD, M.D.

DANGERS TO HEALTH:

A PICTORIAL GUIDE

TO

DOMESTIC

SANITARY DEFECTS,

BY

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1879.

DEDICATED

TO

Those of my medical brethren who have studied, investigated, and corrected the sanitary arrangements of their own houses, in the hope that what is now perhaps a small minority, may before many years are over, become a large majority of the medical men of the United Kingdom.

LEEDS, *Jan. 1st*, 1879.

MAXIMS.

1.—It is the duty of every householder to ascertain for himself whether his own house be free or not from well known dangers to health.

2.—This duty, imperative at all times, is of surpassing urgency in a house where a woman is about to become a mother, or a surgical operation is about to be performed.

3.—The more perfect the public sewers of a town, the greater the danger to every house connected with such sewers, if the internal drain pipes of the house be unsound, and not *disconnected.* In houses so misconnected sewer air is "laid on" as certainly for the detriment of health as coal gas for illumination; and *you can turn off coal gas at the meter.*

4.—Every hotel throughout the kingdom, and in our watering places every house let as lodgings, ought to have its sanitary arrangements *periodically* inspected, and duly licensed.

5.—A house in which children and servants are constantly ailing is probably wrong in its drainage.

6.—If you are about to buy or to rent a house, be it new, or be it old, take care *before you complete your bargain* to ascertain the soundness of its sanitary arrangements with no less care and anxiety than you would exercise in testing the soundness of a horse before you purchase it.

7.—If you are building a house, or if you can achieve it in an old one, let *no drain be under* any part of your house, *disconnect* all waste pipes and overflow pipes from the drains, and place the soil pipe of the w.c. *outside* the house, and ventilate it.

8.—If you are tenants, and your landlord refuses to remedy the evil, *do it at your own cost rather than allow your family to be ill.*

9.—Many a man who would be aghast at the idea of putting small quantities of arsenic into every sack of flour, and so by degrees killing himself and family, does not hesitate to allow sewer gas to poison the inmates of his house, even in the face of the strongest remonstrances of his medical adviser.

10.—If you be a landlord, don't intimidate your tenants or threaten to give them notice to quit if they complain of defective drainage or sewer gas in the house.

TABLE OF CONTENTS.

PLATE

XXIV.—Rain water tank under cellar floor.

XXV.—Sink turned into tank under cellar.

XXVI.—Dishstone communicating with tank under floor.

XXVII.—"Rats, and the tale they tell."

XXVIII.—Dishstone admitting drain gas into larder.

XXIX.—"Dairy sweepings."

XXX.—"How people drink sewage."—Well No. 1.

XXXI.—"How people drink sewage."—Well No. 2.

XXXII.—Overflow of cesspool fouling a wall and floor.

XXXIII.—Broken w.c. drain leaking into a well under a house.

XXXIV.—Square drain forming a cesspool under a tiled hall.

XXXV.—Speculating builder buying "seconds."

XXXVI.—Drain made of "seconds."

XXXVII.—"Road muck" and "midden refuse" for mortar and plaster.

XXXVIII.—Six-inch pipe between four-inch pipes—drain blocked.

XXXIX.—Joints opened by settling of foundation.

XL.—Pipes laid flange downwards.

XLI.—Trap blocked by stones.

XLII.—Drain running up-hill.

XLIII.—"To be continued in our next."

XLIV.—"Disconnected and misconnected."

XLV.—"Poisoned by next door neighbour's drains."

XLVI.—Drain "taking" a rock—sewage "refusing."

XLVII.—Economy in excavation at the expense of fall in a drain.

XLVIII.—Waste pipe of bath and sink cut off, and left open.

XLIX.—"Hunting for drains"—no plans.

L.—"Terrace of the future on the refuse of the past."

LI.—Poisonous wall papers.

LII.—Window ventilator in brougham.

LIII.—Ventilation without dirt—No. 1.

LIV.—Ventilation without dirt—No. 2.

LV.—Dust in glass cases, and how to exclude it.

INTRODUCTION.

When, two years ago, yielding to the urgent request of the Rev. J. H. McCheane, President of the Leeds Philosophical and Literary Society, I undertook to read a lecture before that society and chose as the subject "Dangers to Health in our own Houses," I little thought of publishing a book, still less an illustrated book, on a subject which at first sight may appear to be outside the lines of my strictly professional work.

However, the truth of the matter is this, that having discovered and rectified one by one numerous defects of drainage in my own house, and in property under my charge, and having further traced illness amongst my patients to scandalous carelessness and gross dishonesty in drain work, I became indignantly alive to the fact that very few houses are safe to live in. Moreover, the conviction struck deeply into my mind that probably one third, at least, of the incidental illness of the kingdom, including perhaps much of childbed illness, and some of the fatal results of surgical operations in hospitals and private houses, ("surgical calamities" Sir James Paget would call them,) are the direct result of drainage defects, and therefore *can* be and *ought* to be prevented. "Preventive medicine" has long been proclaiming such facts, and long have we turned a deaf ear, and we of the medical profession in general are only just beginning to see the great reality of her teaching.

If any one challenges this assertion in reference to my own profession, I will reply by the inquiry—How many medical men can he tell me of who understand the sanitary condition of *their own house*, or have adequately ascertained that those conditions are, as far as our knowledge at present goes, free from dangers to health? If by any possibility it could be

brought about that every medical man in the kingdom should realise the necessity for looking into the state of his own house, and act upon that conviction, I feel certain that the discovery would be made in so great a proportion of instances that they were living over pent-up pestilence that we should at once have an army of sanitarians earnest and keen to ferret out unsuspected sources of illness. I take it that not a little of the lively interest recently aroused in Leeds in sanitary work may be traced to the fact that many of the medical men of this town have recently gone into the question of the sanitation of their houses, and have thereby become more keenly alive to possible sources of illness among their patients.

Hence it came about that the lecture was given which was the forerunner of this book. The lecture was delivered by request six times in Leeds, once in Knaresbro,' and once in Shipley. It was published by request of the Leeds Philosophical Society, and has had an extensive circulation.

The interest taken in the lecture and the comments and discussion to which it gave rise taught me two things:

Firstly, that if we are ever to have sound sanitary legislation, if we are ever to have our sanitary arrangements carried out in first-rate workmanship, it must be by *the education of the public in the details of domestic sanitary matters*, so that, realising their vital importance, knowing what ought to be avoided, and able to judge of the correctness and quality of work done, they may *demand* and so obtain first-rate workmanship.

When disease arises which we call "preventable," depend upon it some one ought to have prevented it.

This book will shew work defective from *ignorance*, and work defective from *dishonesty*. Probably no work done throughout the kingdom is so badly done as work in houses, drains, and pipes, which is out of sight. Probably no work is better done in the kingdom than the locomotives turned out for our railways, or the machinery which we send to all parts of the world. Are the working men less honest in the one case than in the other? I trow not. The difference is this: *Necessity*

in the one case compels good work; *indifference* and *ignorance* in the other case allow bad work to pass unchallenged. If the platelayer were so to fix his rails that they would not correspond, and the next engine were thrown off the line, and death were the result, an inquest would be held, and that platelayer would be committed for manslaughter. Is there any great difference in the case where one drain pipe, by missing another, ends in nothing, and in a few weeks, is the cause of death from typhoid fever? The excuse at present is that the drain layer does not know how certainly he is laying the foundation of illness and death. Disperse that ignorance, and the excuse will be gone. If the tire of the locomotive breaks, and throws a train off the line, the railway company goes to the maker of the engine, the maker of the engine to the maker of the tire, the maker of the tire to his books, and there learns the name of each foreman, and, I believe, of each workman, through whose hand the tire passed. Why can we not achieve the same connected responsibility about our drains?

Secondly, it struck me that there was need of some work of which the aim should be to teach in as simple, telling, and unmistakeable a way as possible the faults of sanitary construction which it is within the power of landlord and tenant, as distinct from the public authorities, to remedy and avoid. This latter point was pressed upon me by friends who took interest in the original lecture.

The design therefore which I have set before me is this, to represent pictorially every important fault to which domestic sanitary arrangements are liable, so far at least as my information avails me, or, in the words suggested by a medical friend, to produce "a clinical history of the defects to which drains are liable," and to point out the consequences of such defects by instances of the illness produced thereby.

In designing the illustrations one object has been kept steadily in view, viz., to give the most forcible expression I possibly could of the fact which had to be told, even at the sacrifice, if need be, of correct proportion, correct drawing, or

correct perspective. This must be my general apology for the many points in which the drawings are open to unfavourable criticism.

The points in each illustration to which attention has to be attracted are drawn in strong lines, so that the eye may fix upon them first, and the lines which complete the story are drawn more faintly. The course and escape of sewer gases are indicated by blue arrows. Water in traps, water rendered impure by access of sewer gases, sewage matter in drains, and matter escaping from drains is also in blue.

If it should seem to anyone that the book is defective in that it rarely teaches how the various defects ought to be rectified, my answer is this :—

Firstly, that, when we have discovered what is wrong, we are more than half way to what is right.

Secondly, that in pointing out what is wrong, I am dealing with matters which cannot be questioned—with established and accepted principles. No one can question the fact of "a leaky joint," "a broken pipe," or "a drain running up-hill" being faulty. But in advising what ought to be done, I should be in danger of going beyond my depth, of trenching upon the province of experts, officers of health and sanitary engineers, and I should be touching on matters concerning which there may be various solutions, various opinions, and changes in course of time. What is best to-day may be superseded by what is still better to-morrow. If in any case I point out the remedy for a fault it is rather with the object, either by *contrast* to produce a more vivid impression of the original fault, or to give a *standard below which* the remedy ought not to fall. Moreover, in most instances where a remedy is suggested, a standard authority is cited for the practice.

The illustrations are planned so that each *as a rule*, represents a single defect, and they are arranged so that the more common and obvious faults of ordinary drains come first, those which are less obvious, more rare, and more difficult to discover come next, then some of the rascalities of dishonest builders are pourtrayed, lastly there are added drawings as

hints on ventilation, and on the exclusion of dirt from town houses and closed cases.

It is but just that I should acknowledge the kind aid without which I could not have obtained the knowledge or have produced the quality of illustrations contained in this book. My thanks are due —

Firstly, to Mr. C. R. Chorley, Architect, of Leeds, who has superintended the sanitary alterations of my own house, has informed me of many common defects, and contributed some of the sketches from his own experience.

Secondly, to Mr. Robert Slater, Plumber, of Headingley Hill, who has executed all my sanitary plumbing, has instructed me in the defects of plumbing and drains, and has informed me of defects which he has discovered in the various houses, which, owing to illness and other reasons, he has been called upon to inspect.

Thirdly, to Mr. G. W. Foster, Artist, of Headingley, who has thrown some of my sketches into an artistic form; and lastly, to Mr. Wm. Burton, Lithographer, who has executed the drawings on stone with the greatest pains and care, and has given an artistic finish to my otherwise crude sketches.

If the object aimed at has been in some degree achieved, it may be hoped that this work may be of service —

To the *householder*, who is anxious to learn whether his house is safe from drainage dangers or not, so that, aided by the diagrams, he may test every sanitary point, one by one, and, as he goes round book in hand, may catechise his plumber, his mason, or his joiner. This is the chief aim of the book.

To the *landlord*, who may learn thereby, if he does not realise them already, his responsibilities as to the health and lives of his tenants, and may feel that to save money by scamping drainage is "manslaughter under an *alias*."

To the *medical attendant*, who may point to the pictures in the book, in order to strike conviction into the minds of his patients of the sure connection between bad drainage and ill health.

To the *architect* who may learn how by every sanitary detail which he designs amiss, or by oversight allows to be badly carried out, he is opening a door for illness to the future occupant of the house.

To the *officer of health*, who may appeal to the drawings to enforce his warnings of the dangers involved in faulty drains.

To those *entering a new house*, that they may be forewarned of the risks they run if they take the sanitary arrangements of a house on trust.

To *those about to build*, that they may know what to avoid, and what to look after, and may be able to discuss intelligently with their architect, builder, and plumber, those vital points of construction on which the health of themselves and their family will depend.

To *Town councillors* and *members of local boards of health*, that they may checkmate any of their colleagues who may have been elected to office in order to hamper or impede expenditure on sanitary work.

To *public opinion*, as one agent among many by which it is rapidly being matured, and prepared to support when the proper time arrives, sound, genuine, not sham, sanitary legislation, and to demand of architects, builders, and plumbers, honest trustworthy drain work—work in matters affecting health as sound and as perfect as is now demanded and obtained in locomotives, machinery, and engineering.

Finally, let me say how fully aware I am that it is impossible in this book to include all known defects of drains, and that many omissions, probably important ones, will be discovered. Still, I trust, in a future edition, to be able to remedy any serious omissions which friends or critics may point out to me.

PLATE I.

House with every sanitary arrangement faulty.

This plate is intended to shew at one glance the most common sanitary faults of ordinary houses. In subsequent plates each fault will as a rule for the sake of clearness be given singly in order that it may be more easily understood.

A. Water-closet in the centre of the house.

B. House drain under floor of a room.

C. Waste-pipe of lavatory—untrapped and passing into soil-pipe of w.c., thus allowing a direct channel for sewer gas to be drawn by the fires LL into the house.

D. Over-flow pipe of bath untrapped and passing into soil-pipe.

E. Waste-pipe of bath untrapped and passing into soil-pipe.

F. Save-all tray below taps untrapped and passing into soil-pipe.

G. Kitchen sink untrapped and passing into soil-pipe.

To these might have been added a housemaid's sink.

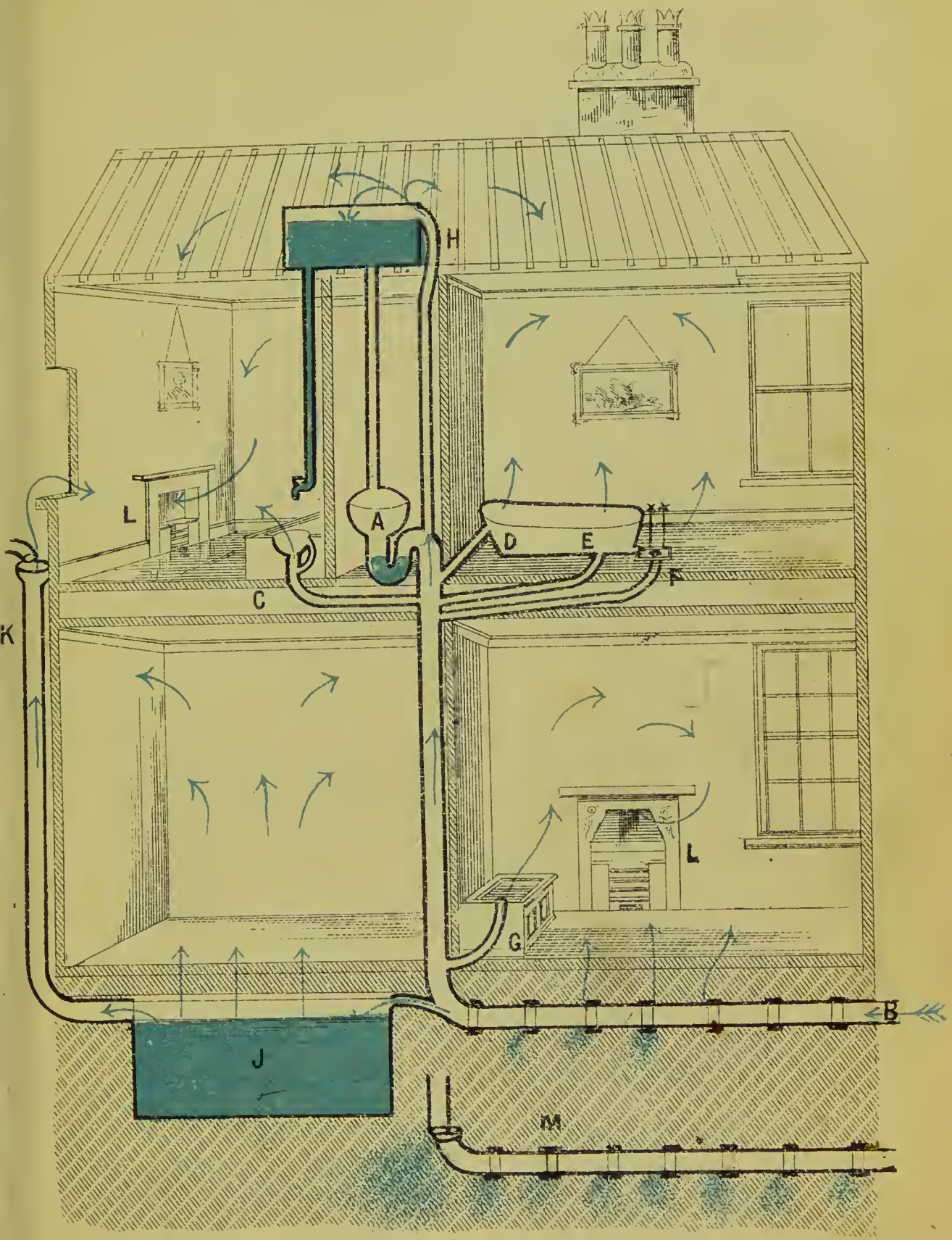
H. Water-closet cistern with over-flow into soil-pipe of w.c. thus ventilating the drain into the roof, polluting the air of the house, and polluting the water in the cistern, which also forms the water-supply of the house for drinking and washing.

J. Rain-water tank under floor, with over-flow into drain.

K. Fall-pipe conducting foul air from tank fouled by drain gas, and delivering it just below a window.

M. Drain under house with uncemented joints leaking; also a defective junction of vertical soil-pipe with horizontal drain; the drain laid without proper fall.

PLATE I.



T P T Inv.

House with every sanitary arrangement faulty.

PLATE II.

House with faulty sanitary arrangements avoided.

This plate is intended to shew the reverse of the last, and to indicate the manner in which the faults can be rectified, but does not profess to lay down a strict rule as to the best arrangements.

A. Water-closet against outer wall of house, with soil-pipe passing directly out of the house, and ventilated by a pipe continuing the soil-pipe above the eaves, and away from chimneys or windows.

B.B. House drains entirely outside the house.

C. Lavatory.

D. Over-flow of bath.

E. Waste-pipe of bath.

F. Save-all tray of bath.

G. Kitchen sink, to which might be added a housemaid's sink, all trapped, and *disconnected* from the drain, and discharging into an open gully trap, L.

H. Over-flow of cistern into the open air.*

K. Fall-pipe near bedroom window discharging into gully L.

M. Domestic cistern distinct from w.c. cistern.

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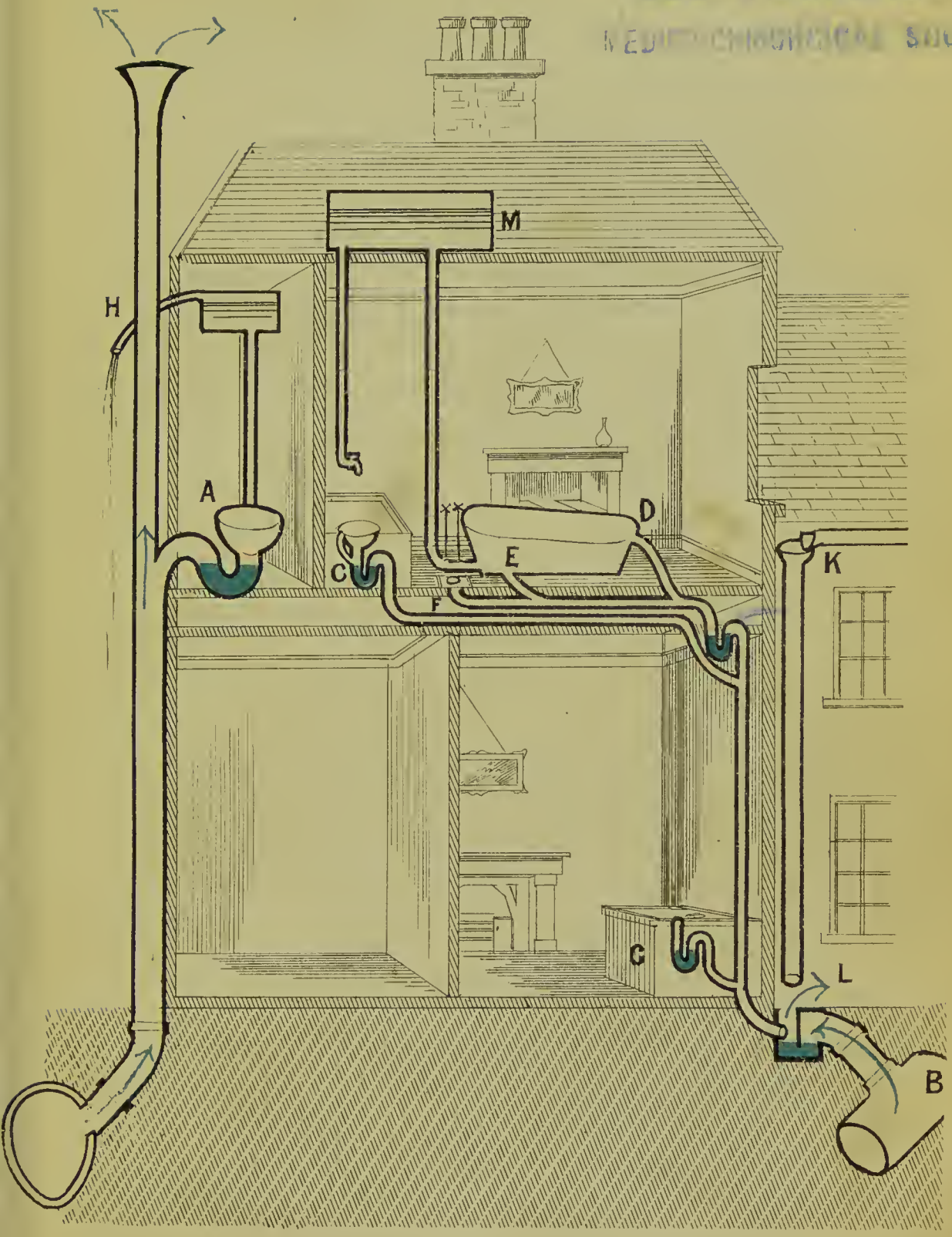
* Required by rule of Waterworks Committee of Leeds Town Council. Building bye-laws of Leeds, 33f, 33i, 33j, 40, 53. *Vide* appendix.

PLATE II.



T.P.T. Inv.

House with faulty arrangements avoided.

Flame of Candle at the keyhole and the lessons it teaches.

This drawing is intended to enforce *five* lessons :—

1st. That architects as a rule make no provision whatever for the air which is to feed the chimney. An ordinary fire draws about 150 cubic feet of air per minute. If the house is well built, and the windows, doors, and floor boards fit well, the chimney smokes, unless the door or window be open.

2nd. That in the absence of any provision for the admission of air, and with the window shut, the supply of air comes from various irregular sources ; a small portion, indicated by black arrows, through window chinks ; the main portion, indicated by blue arrows, through the keyhole and crevices in the door stead, skirting boards, and floor boards. These "irregular" streams of cold air pass for the most part horizontally towards the fire, and chill the occupants of the room ; and the more furnace-like the fire, the stronger the cold draught which traverses the room.

3rd. That a very moderate opening in the window is enough to stop all "irregular" draughts, the air taking the easiest course, and abandoning circuitous and contracted channels.

4th. That with a window shut, the greater part of the chimney draught is supplied from the house, and that if the air of the house be "drain-derived," then "drain-be-fouled" air must fill the room.

5th. That if illness "drain-begotten" breaks out in a "drain-be-fouled" house, and the patient cannot be removed, the safest course will be to open the *bottom* sash of the window to the extent that will allow a flame at the keyhole to burn in repose ; and then to convert the horizontal draught into a vertical one by a board or cloth 6 or 8 inches high, fixed about 2 inches from the window.*

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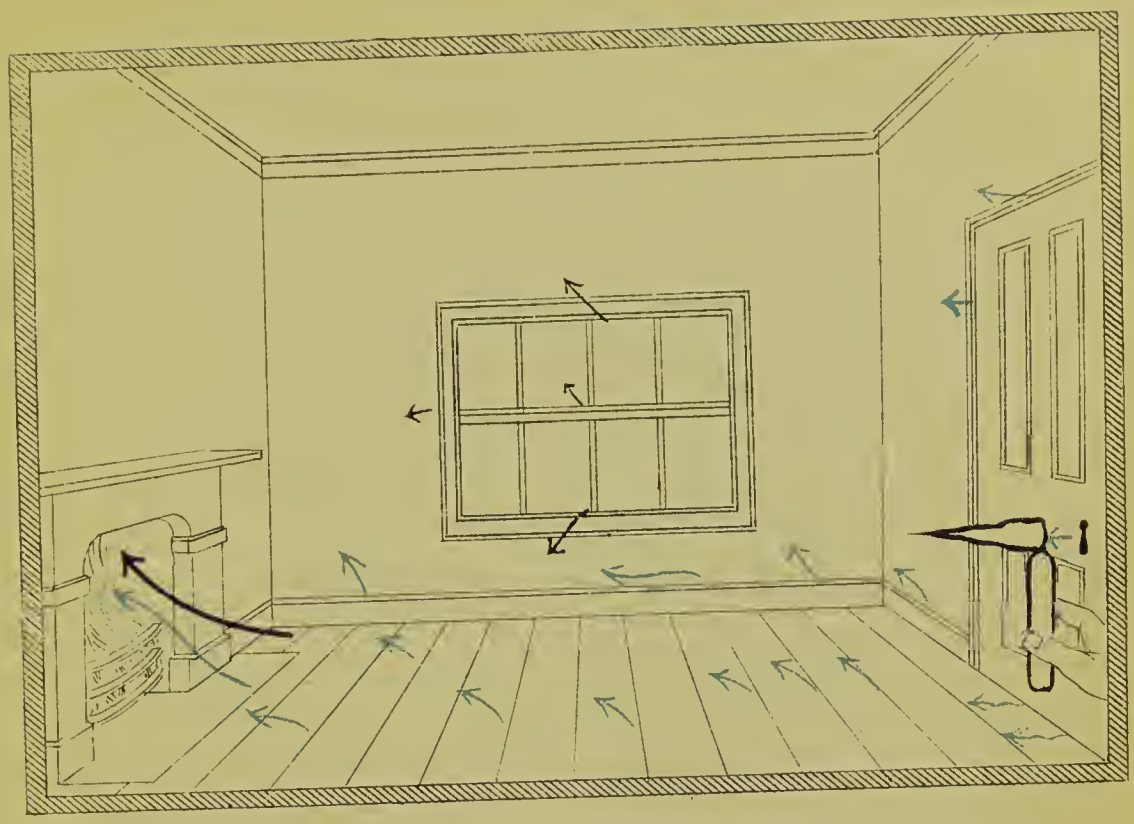
* Mr. F. Hinckes Bird on Costless Ventilation.—*Builder*, 1862.

PLATE III.



"A" window shut. Flame at the keyhole horizontal.
"How architects don't provide for the chimney draught."

T. P. T. Inv.

"B" window open. Flame at the keyhole in repose.

PLATE IV.

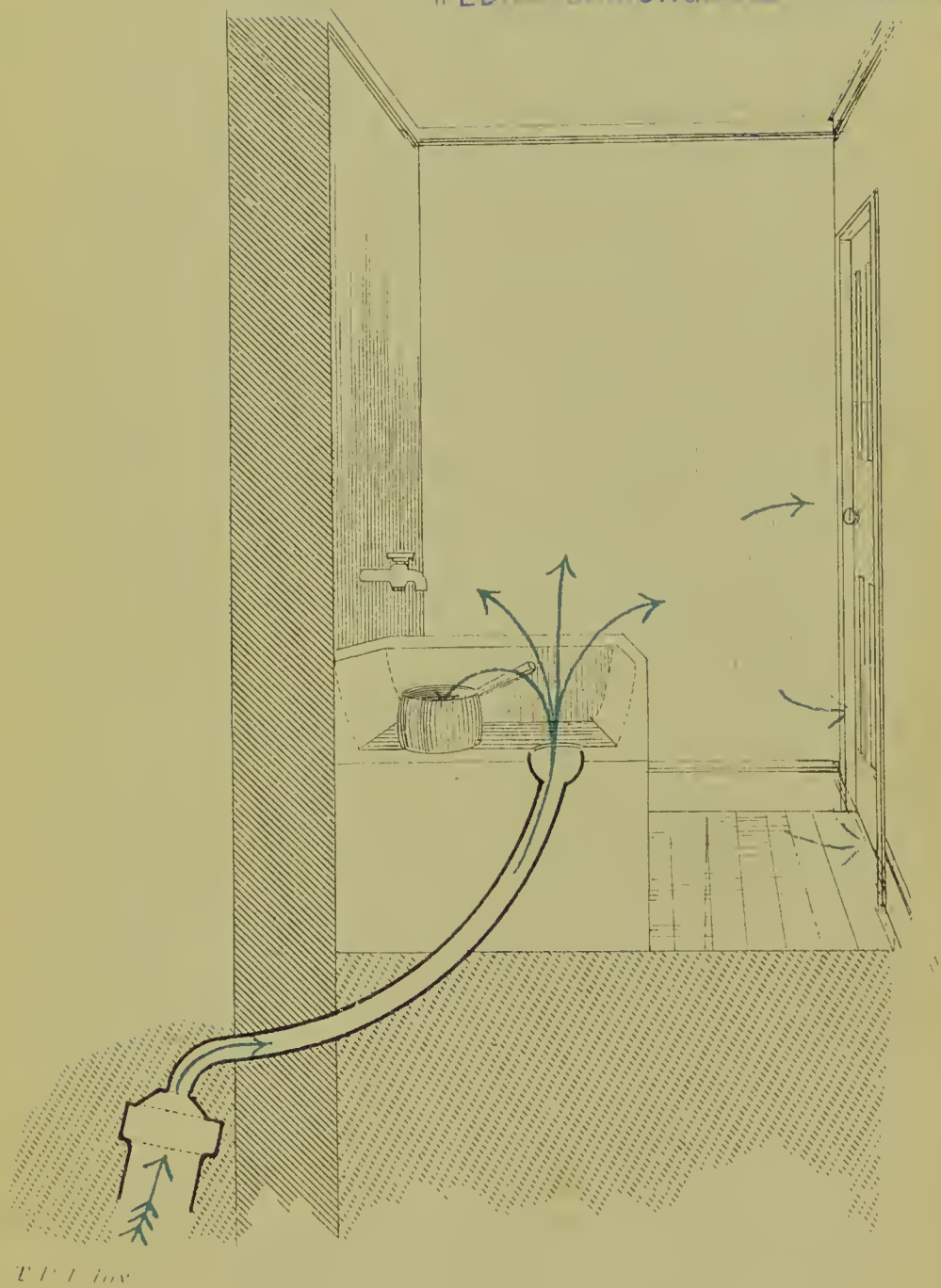
Waste pipe of kitchen sink, untrapped, passing direct into drain.

Here are two faults—one, the absence of a syphon trap, which allows the air of the sewer to be drawn in full stream by the fires into the house, perhaps at the rate of several cubic feet per minute, and with a current strong enough to blow out a candle; the other the direct, unbroken passage of the pipe into the drain.

This is the state of the sinks of most cottages and houses which have not been recently built under the rule of "building bye-laws" of a town, or have not recently been inspected and corrected; and is almost universal in old country houses. It is probably the cause of head-ache, sore throat, and depressed health to many a cook, kitchen-maid and butler, and perhaps indirectly leads, in not a few instances, to the use of those treacherous self-prescribed medicines—spirits and beer.

What ought to be done to remedy the thousands of "disease-begetting" sinks in the cottages in our large towns? This is a question for the local or central sanitary authority to face and decide.

PLATE IV.



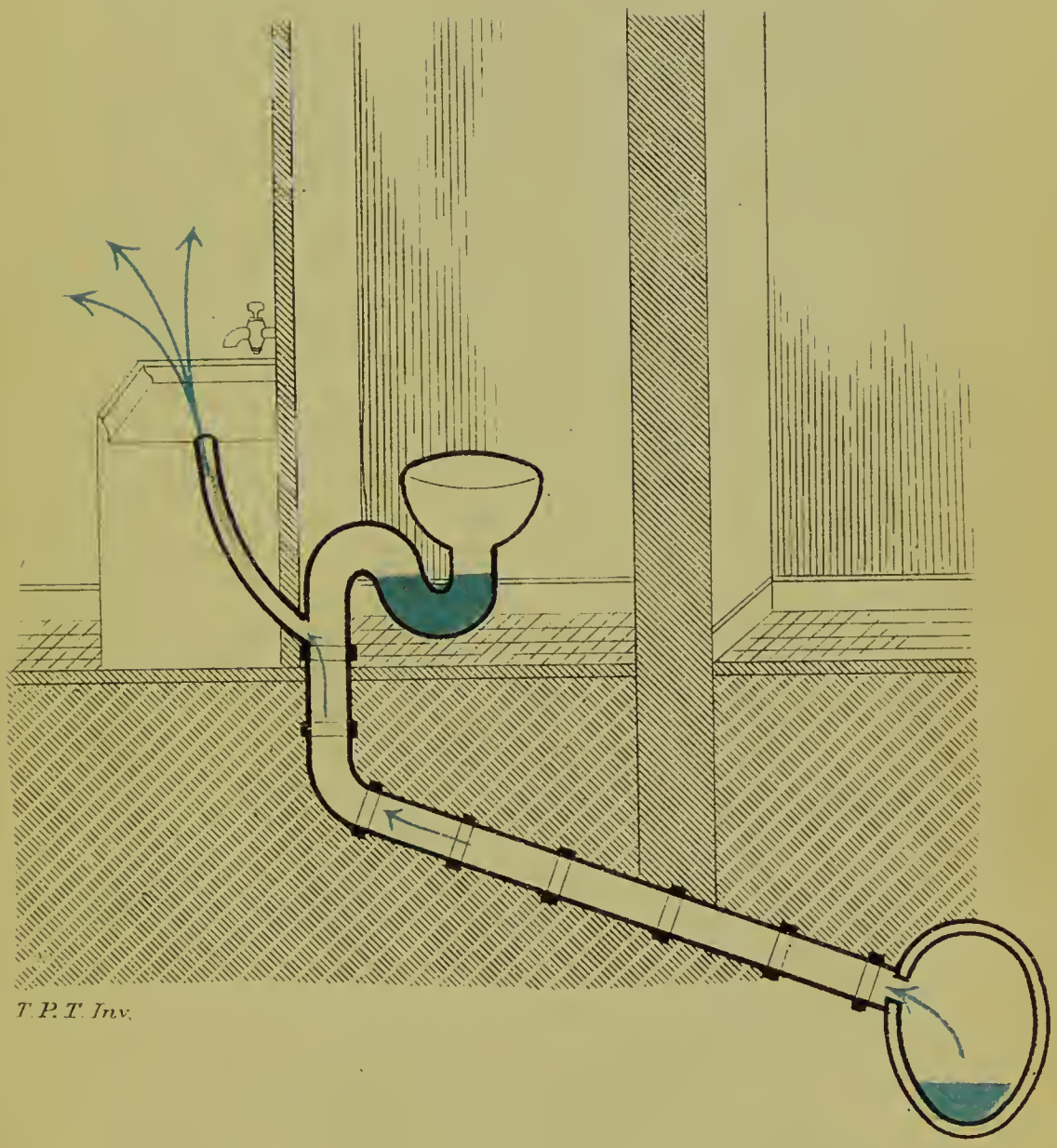
Waste pipe of kitchen sink, untrapped, passing direct into drain.

PLATE V.

Waste pipe of kitchen sink, untrapped, and passing into soil pipe.

This was found in a house recently occupied by a relative of my own. The w.c. soil pipe being conveniently near, had been tapped by the ignorant or indolent plumber to receive the waste pipe.

PLATE V.



Kitchen sink carried untrapped into soil pipe of w.c.

PLATE VI.

Scullery sink discharging into a grate guarding an untrapped sewer.

This drawing was contributed by Mr. Chorley, who discovered the defect in the house of a relative.

Mr. C. had noticed a drain smell in the hall and lower part of the house. On investigation, he found the sink pipe (A) delivering its waste water into a grate (B) which covered a sinkstone of an untrapped drain. This drain joined a w.c. drain running under the house. In the same house he found an untrapped sinkstone in the "keeping cellar." Before these faults were discovered and remedied the lady of the house was constantly in ill-health. Since the correction of the faults her health has been perfectly restored.

PLATE VI.

Scullery sink discharging into grate of untrapped sewer.

PLATE VII.

Kitchen sink with faults corrected.

Fault one corrected by a "syphon trap" (A). (Building bye-laws of Leeds, 33 i.)

Fault two corrected by "the waste-pipe being taken through an external wall of the building to discharge into a trapped gully grating" (B). (Building bye-laws, 33 i.)

In this case the syphon trap prevents any current of air being drawn into the house through the waste-pipe from the surface of the water in the gully trap. The gully trap shuts off the sewer air from the grating. The faint blue arrows from the grating indicate, 1st, that the water in the gully is not pure, and that the gully needs periodical cleansing; 2nd, that the water-trap does not entirely shut off sewer gases, which slowly pass through the water by absorption, and escape into the open air through the grating.

In this drawing, the waste-pipe delivers into the "gully" *below* the grating as a precaution against frost. Some authorities insist upon the pipe delivering *above* the grating.

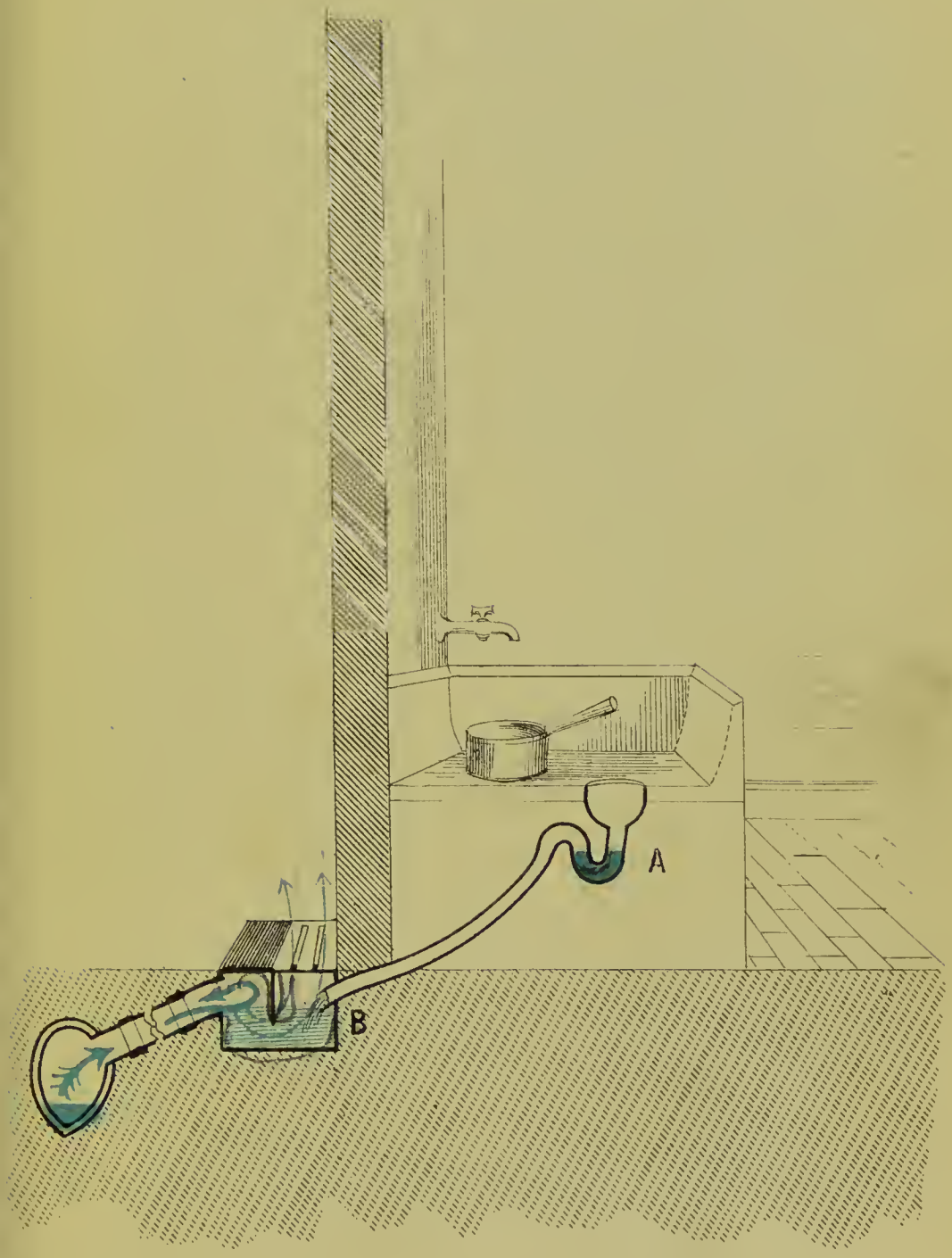
Professor Rolleston tells me of the caution that the gully to a kitchen sink ought to be *large* in order to intercept the grease, especially in a limestone district in which the lime in the water forms a stearate of lime which rapidly coats and fouls drain pipes.

Dr. Fergus,* of Glasgow, says:—"I was the first to point out, some four years ago, that a much more important factor in its (sewer gas) admission into house drains is the diffusion of gases through water." As the result of experiment he detected ammonia in 15 minutes, sulphurous acid in 1 hour, sulphuretted hydrogen in 3 to 4 hours, chlorine in 4 hours, &c.

Professor Osborne Reynolds, of Manchester, tells me in a note, "My experience as regards water-traps is that, if the trap is a trap, the amount of sulphuretted hydrogen or ammoniacal gas which will pass by saturation through the water is insignificant. Where water-traps fail is in the fact that the waterlift in the trap is insufficient to block the way."

* Edinbro' Medical Journal, July, 1878.

PLATE VII.



T. P. T. Inv.

Kitchen sink with faults corrected.

PLATE VIII.

Defects in lavatories and baths, and their remedies.

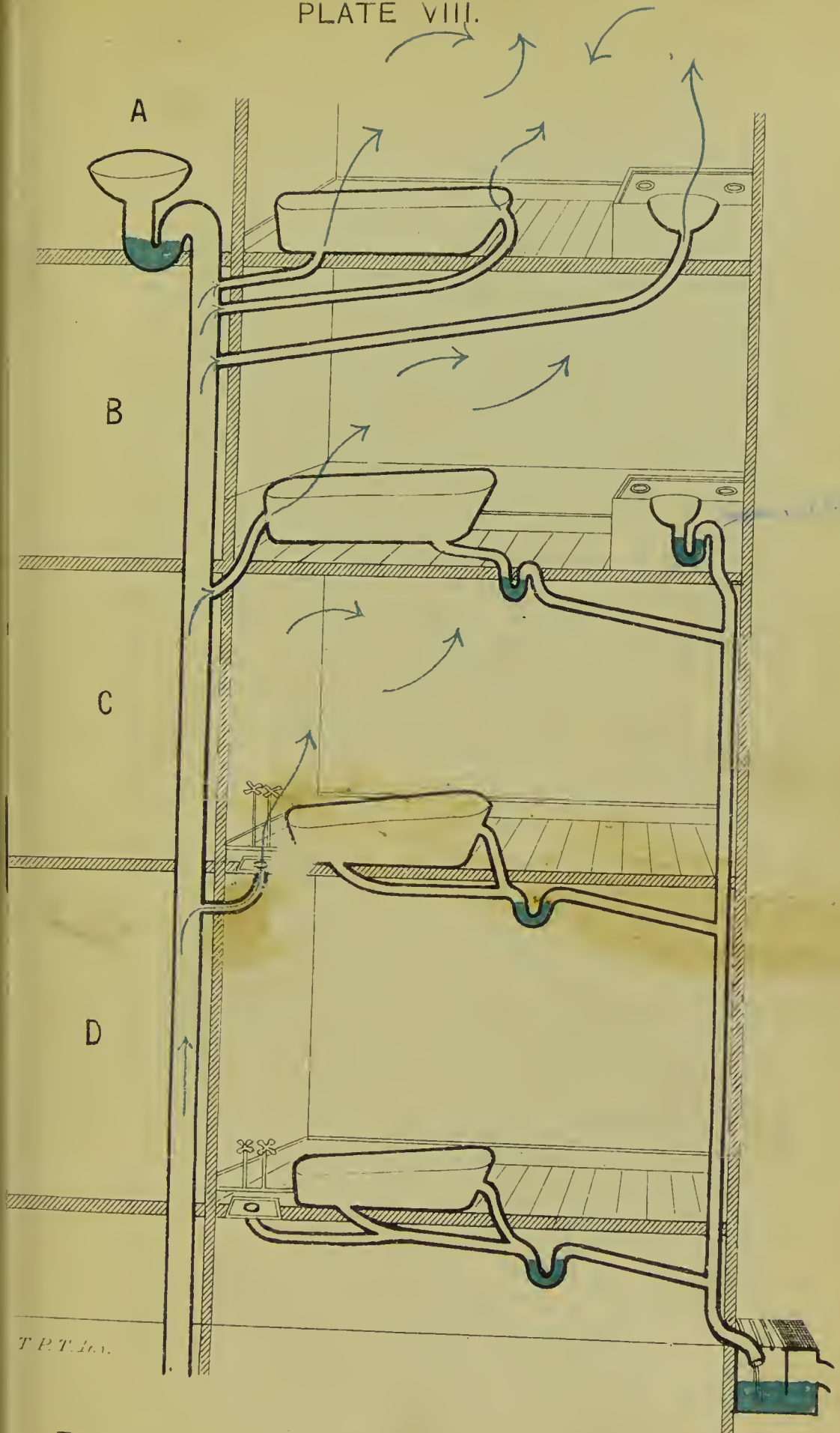
A. Waste-pipe of lavatory, waste and over-flow pipe of bath, all untrapped and passing into soil-pipe of w.c.

B. Lavatory waste-pipe trapped and discharging into open gully outside the house. (Building bye-laws). Waste-pipe of bath also remedied, but the "over-flow" still untrapped and joining soil-pipe. It is not uncommon to find that, the waste-pipe being trapped and delivering into a drain or gully, after a while the bath over-flows. Another plumber is then called to add an over-flow pipe, who, ignorant of his business, takes the over-flow untrapped into the nearest communication with a drain, which is usually the soil-pipe of a w.c.

C. In this drawing, both waste and over-flow of bath are properly guarded by a trap, and properly conducted into the open air, but by an oversight the "save-all" tray for catching the drippings of the taps has been connected directly with the soil-pipe, thus vitiating the whole arrangement. This fault was recently discovered close to the bedroom of a gentleman suffering from whitlow with inflammation spreading up the arm, his medical man having insisted on a close investigation of the drains of the house under the conviction that some such cause was needed to explain the attack.

D. All pipes from bath correctly arranged.

PLATE VIII.



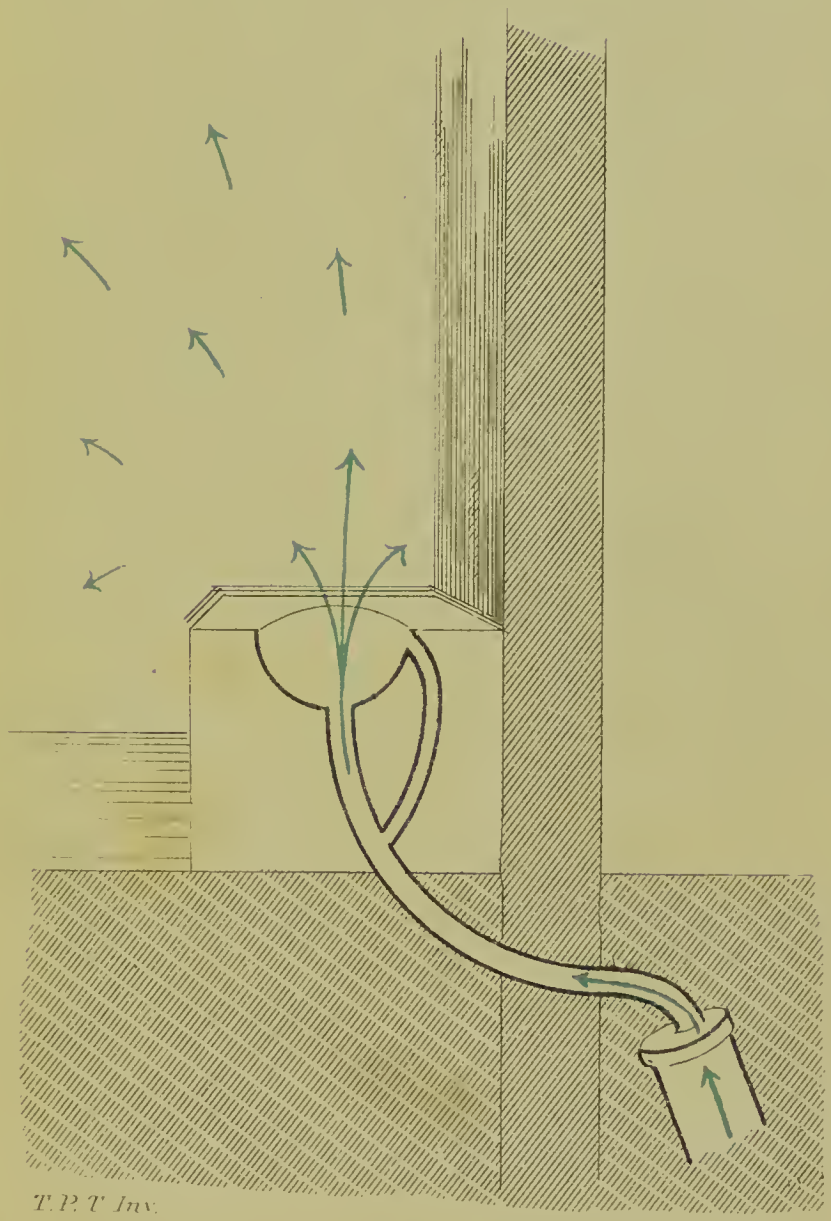
Defects in lavatories and baths, and their remedies.

PLATE IX.

Waste and overflow pipe of a lavatory passing untrapped direct into a drain.

This plate is almost a repetition of Plate IV.

PLATE IX.



Waste and overflow pipe of a lavatory passing untrapped into a drain.

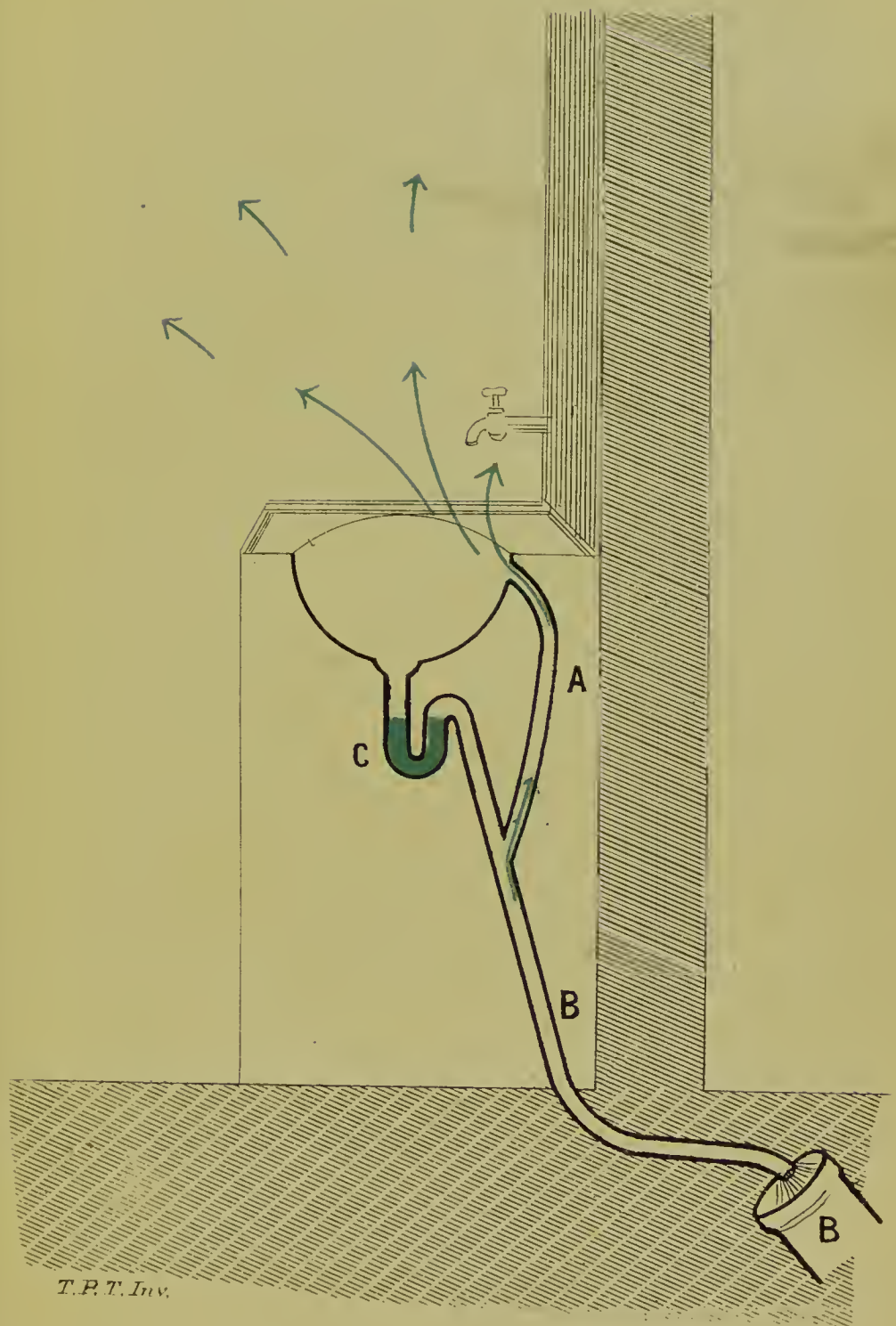
PLATE X.

Lavatory with overflow joining the waste-pipe below the trap.

In this instance (not very uncommon, though a violation of common sense) the trap was rendered useless because the over-flow (A) communicated directly with the drain (B,) and missing the trap (C,) served as a ready channel for the passage of sewer gas.

It was discovered in the house of Mr. E. Atkinson, surgeon, of this town, a house sold to him as recently fitted up with all sanitary convenience and precaution.

PLATE X.



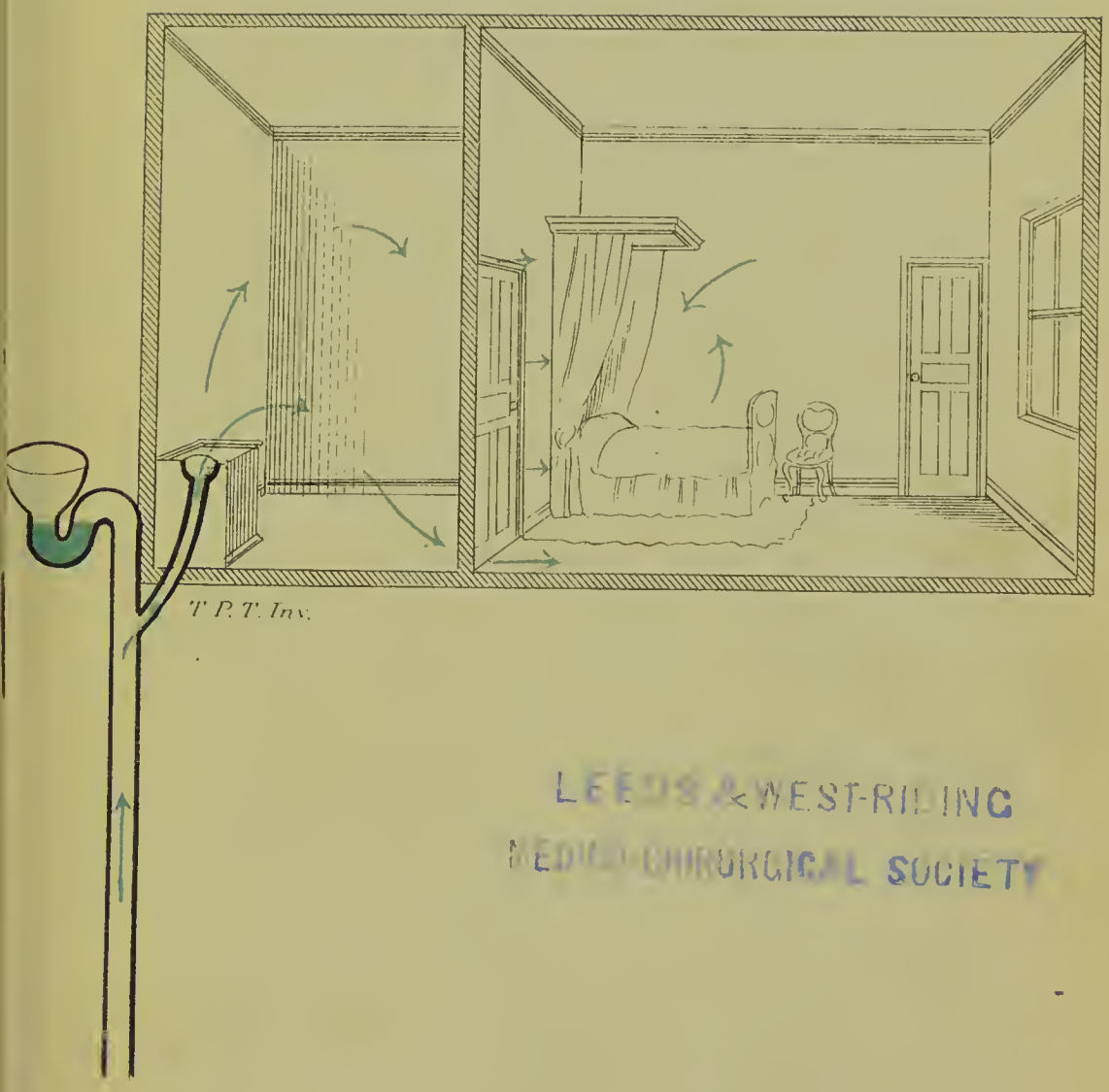
Lavatory with overflow joining waste pipe below the trap.

PLATE XI.

Waste-pipe of lavatory in a dressing-room passing untrapped into a drain or soil-pipe.

This condition along with other faults was discovered in the house of a medical man whose wife had been dangerously ill from puerperal fever. Her accouchement being again in prospect the husband very wisely had the sanitary condition of the house enquired into, and this and several other serious defects were discovered. All was set right, and on this occasion the lady recovered without a drawback.

PLATE XI.

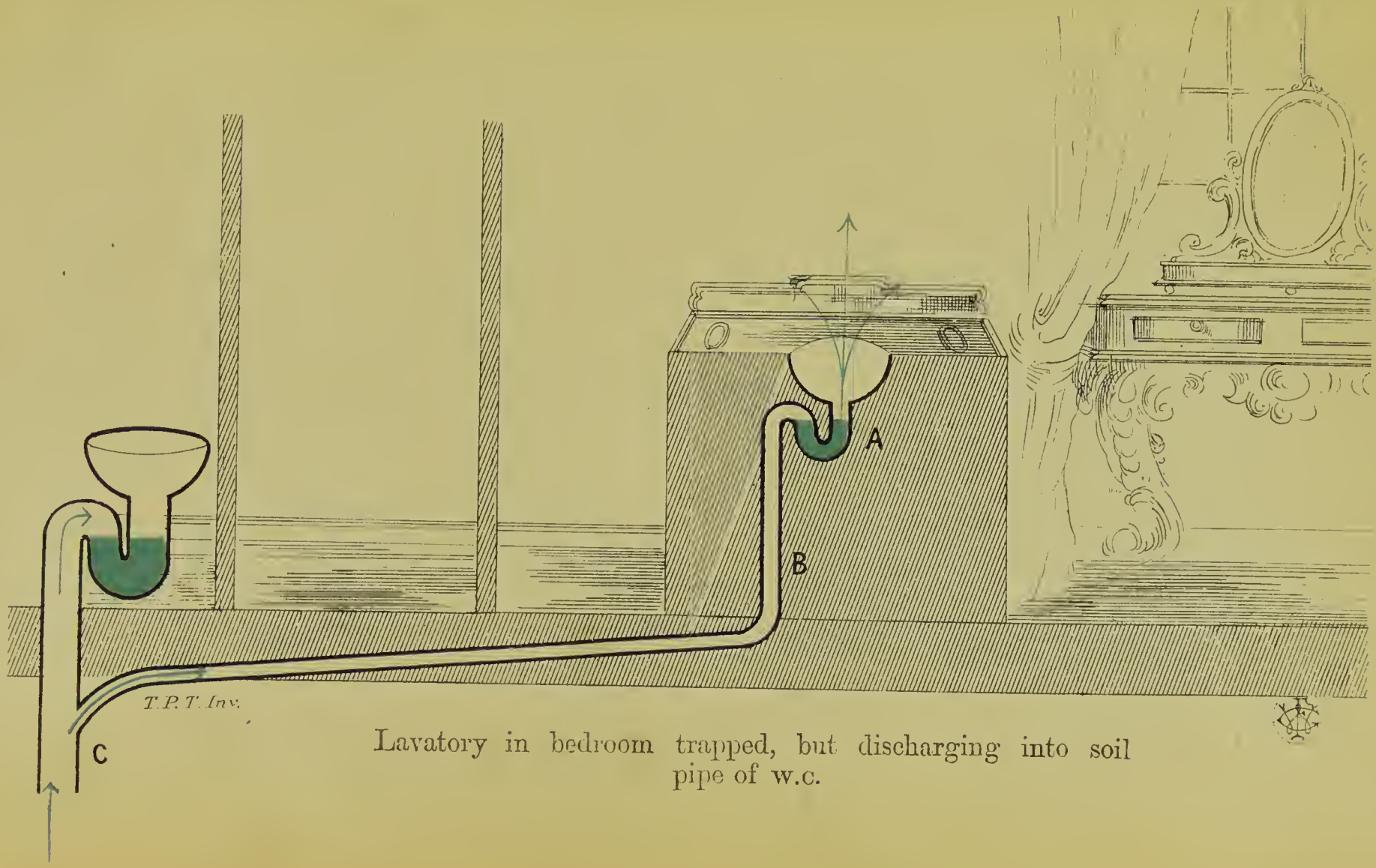


Lavatory in dressing-room opening out of bedroom with waste-pipe untrapped and connected with soil-pipe.

PLATE XII.

Lavatory in bedroom trapped but discharging into soil-pipe of w.c.

The syphon trap (A) prevents any rush of air being drawn through the waste-pipe (B,) but does not prevent the slow passage of foul gases from the w.c. drain, (C,) indicated by the faint arrows rising from the basin. The gentleman occupying the bedroom from which this illustration was taken, was suffering from erysipelas of the face, and was about to undergo a surgical operation. His surgeon refused to do any operation until the lavatory pipe was cut off from the drain, and made to discharge into the open air. It is right to add that the w.c. was in the centre of the house, and that the drain ran under the hall floor.



Lavatory in bedroom trapped, but discharging into soil pipe of w.c.

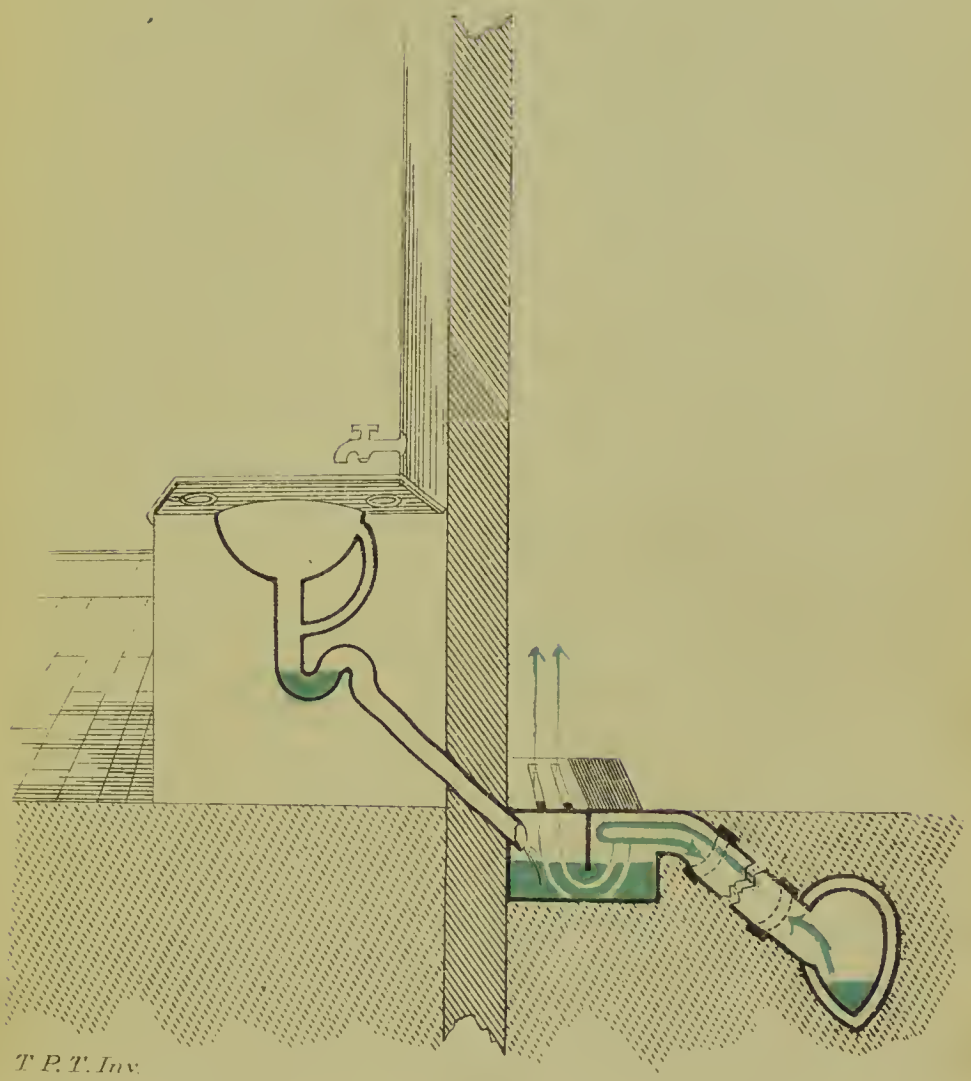
PLATE XIII.

Lavatory with faults corrected.

Compare remarks on Plate VII., which entirely apply to the present case.

N.B.—The *overflow* pipe of the lavatory joins the waste-pipe *above* the syphon trap, a point sometimes overlooked. (*Vide* Plate X.)

PLATE XIII



T. P. T. Inv.

Lavatory with faults corrected.

PLATE XIV.

"Unsyphoned" Trap.

This is an attempt to suggest in a diagram the effect of water in motion.

When the water is being run off from the bath (B,) the falling column of water as it rushes past the entrance of the pipe of the lavatory (C) sucks the water out of the trap of the lavatory, "unsyphons" it, and leaves it open to the drain until more water is let in to fill the trap.

The same is said to occur in the case of water-closets, (FDE) where a series, one above the other, discharge into the same soil pipe, an arrangement more common in London than elsewhere.

What is the remedy? Let me quote from Mr. J. A. Russell's. lectures to Plumbers and Builders, page 19.*

"6th. Traps may be unsyphoned by a body of water "coming down the soil pipe from a fitting higher up on the "same stack. Such a body of water will act like a piston, "compressing the air in front of it, and making suction "behind it. One gallon of water fills nearly 39¼ inches of "3 inch pipe, 28·8 of 3½ inch, 22 of 4 inch, and 17·43 of "4½ inch. The remedy is to have a ventilating inlet joining "the highest point of the bend on the distal side of the trap, "and if the vent be taken from the soil pipe higher up, (and "not from a separate air pipe, or a grating to the open air,) "the above data will indicate the proper distance."

---

* Sanitary houses, by J. A. Russell, Lecturer on Sanitation at the Watt Institution, Edinbro'.—*Maclachan and Stewart.*

PLATE XIV.

T. P. T. Inv.

"Unsyphoned" traps.

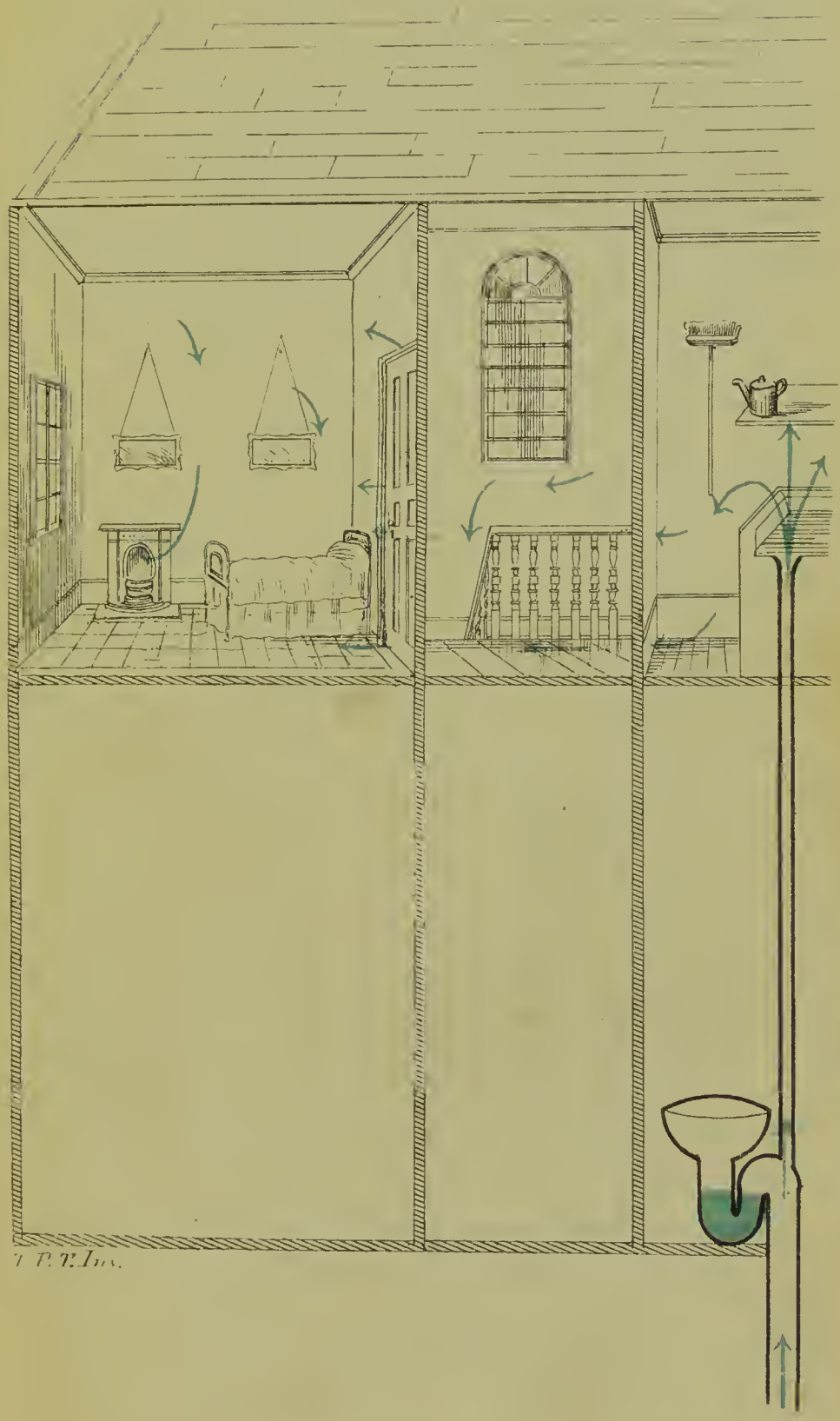
PLATE XV.

Housemaid's sink-pipe untrapped and discharging into a soil-pipe.

This plate seems but a repetition of the untrapped lavatory, but is introduced because the housemaid's sink, often in a dark corner, is apt to be overlooked even when all proper care has been taken with lavatories and baths.

This instance is communicated to me by Mr. Nicholson Price, surgeon, of Leeds. He had recently removed to a house the property of the Leeds Infirmary. In three or four months two of his children became seriously ill with inflamed throat. The sanitary condition of the house was suspected, and investigated, and it was found that two housemaids' sinks near the bedrooms, passed virtually untrapped into soil-pipe and drain.

PLATE XV.



Housemaid's sink-pipe passing untrapped into a soil-pipe.

Water-closet with arrangements all faulty, compared with w.c. with the faults remedied.

As the arrangement of the w.c. is to many persons a source of great anxiety, I have felt obliged to depart somewhat from the rule laid down, and to suggest a plan which seems to be free from serious objection, and which has been adopted in my own house. Suggestions for w.c. arrangements being so numerous, often so complicated and costly, I felt that it would be wrong not to give a pattern which seemed to be free from objection.

In No. 1, the pan (A) is a "pan-closet" very common, and objectionable because of the large cavity between the pan and the trap. This cavity becomes foul, and a receptacle for foul air, which either passes through the water by absorption, or is displaced into the house when the closet is used. In No. 2, the "pan-closet" is replaced by a simple syphon sanitary basin.

In No. 1, the soil-pipe (B) is inside the house, and if faulty at any part, allows the escape of dangerous gas into the house.

The soil-pipe may be faulty,—

(*a*) At the junctions with the pan above, or the drain below, from the joints being badly made, "putty joints" instead of soldered joints, or the pipe may have settled, and so have opened the joints;—

Or, (*b*) The lead pipe may be "seamed" instead of "drawn," and so liable to gape at the seam;—

Or, (*c*) The lead pipe may be old, twenty or thirty years, and eaten through by the sewer gas;—

PLATE XVI.

W.C. Faulty. Faults corrected.

Or, (*d*) The soil-pipe may be made of short sanitary tubes, affording many joints for insecurity and the escape of sewer gas;—

Or, (*e*) The soil-pipe may by its weight have broken the earthenware junction with the drain, thus allowing the discharge of the sewage beneath the floor of the house. *Vide* Plates I., XXXIII., XLII.

In No. 2, these risks are avoided by carrying the soil-pipe outside the house, to join an outside drain.

In No. 1, (D,) the drain is underneath the house, and if it is laid wrongly, without proper fall, Plate I., XLII., or badly, with unluted joints, Plate I., or of broken, *i.e.* "seconds" pipes, Plate XXXVI., or if the foundation sinks, Plate XXXIX., a cesspool is formed at every leaky point within the house, Plate I.

In No. 2, the drain (D) is entirely outside. On "drains under any building," compare Building bye-laws, § 33f.

In No. 1, the cistern (E) has its overflow into the soil-pipe, thus acting as a ventilator to the drains, and conducting the sewer gas into the roof, and thence into the rest of the house.

In No. 2, the overflow of the cistern discharges into the open air—in accordance with the bye-law of the Waterworks Committee, of the Leeds Town Council.

In No. 1, the soil-pipe is unventilated except by the overflow pipe of the cistern.

In No. 2, the soil-pipe (F) is "continued upwards without diminution of diameter," above the eaves "to such a height and in such a position as to afford, by means of the open end of such pipe, a safe outlet for sewer air," or in other words the

ventilating pipe must not end anywhere near a window, see Plate XXII., nor a chimney top, (Building bye-laws, § 53).

In No. 2, there is an open air grate (G,) to allow the free passage of air up and down the soil-pipe, and to prevent the accumulation of foul gas on the drain side of the water trap of the w.c. basin.

In No. 2, there is a syphon trap (H) to cut off the sewer gas from the soil-pipe, with a tube closed by a moveable top by which access can be gained to any stoppage in the trap.

Besides all this there must be a ventilating tube on the drain side of the syphon trap (H).

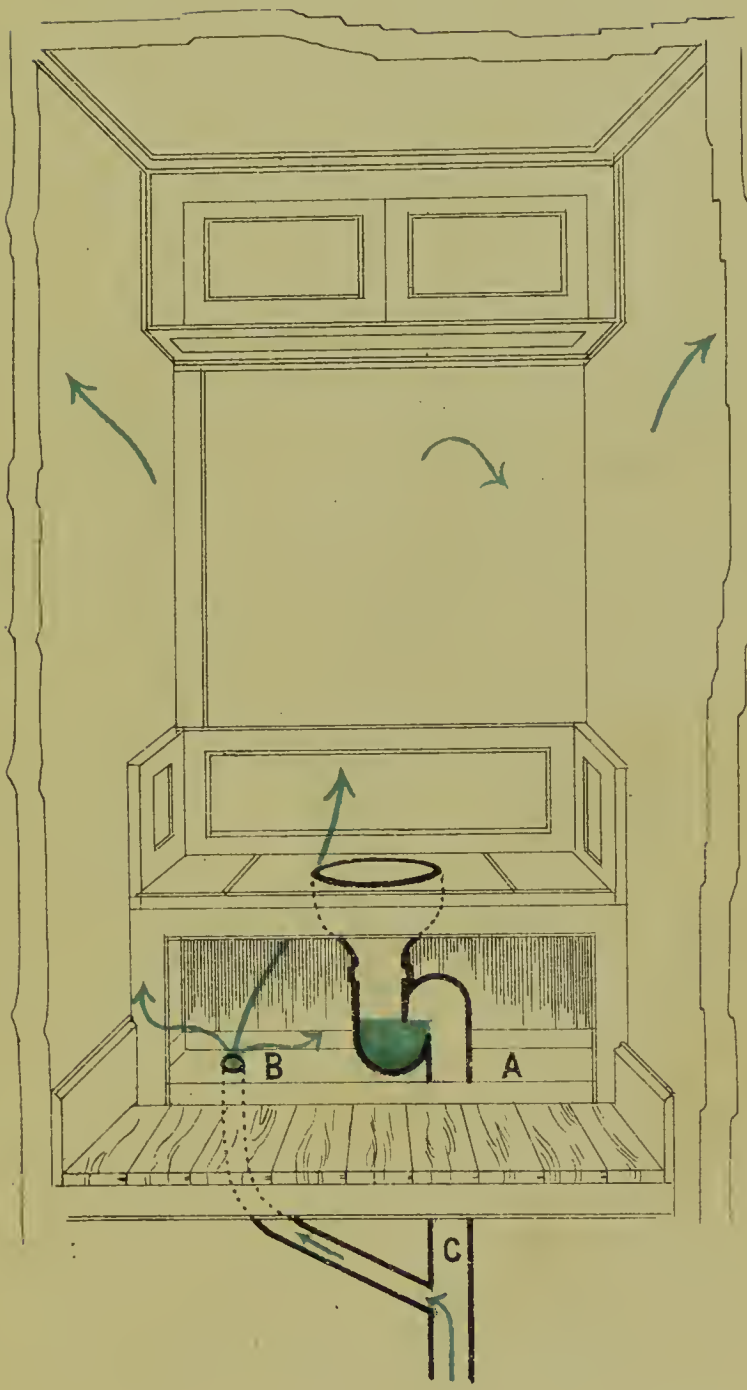
On the subject of "ventilation of drains," Dr. Clifford Allbutt tells me of a case of typhoid fever attended by himself and Dr. Dobie, of Keighley, "due to the magnificent completeness of the whole drainage, done at great cost, including an equally magnificent cesspool, 300 yards away, and all absolutely tight, and so *unventilated* anywhere"—except into the house through the water-traps.

PLATE XVII.

"Save-all" tray beneath w.c. with untrapped waste pipe serving as unsuspected ventilator to soil-pipe.

This drawing was communicated to me by Mr. C. R. Chorley who discovered it in a house in which very great pains had been taken with the waste pipes and drains. The "save-all" (A,) is sometimes placed under a w.c. to catch any chance overflow when slops are carelessly emptied into the pan, and the waste pipe (B) is, naturally perhaps, but most disastrously carried untrapped into the soil pipe (C). Even a trap is a "snare," as Dr. Clifford Allbutt said, because it only acts when there has been great carelessness resulting in an overflow sufficient to fill the trap, and this will soon evaporate.

PLATE XVII.



"Save-all" tray beneath w.c., with untrapped waste-pipe acting as ventilator of soil-pipe.

PLATE XVIII.

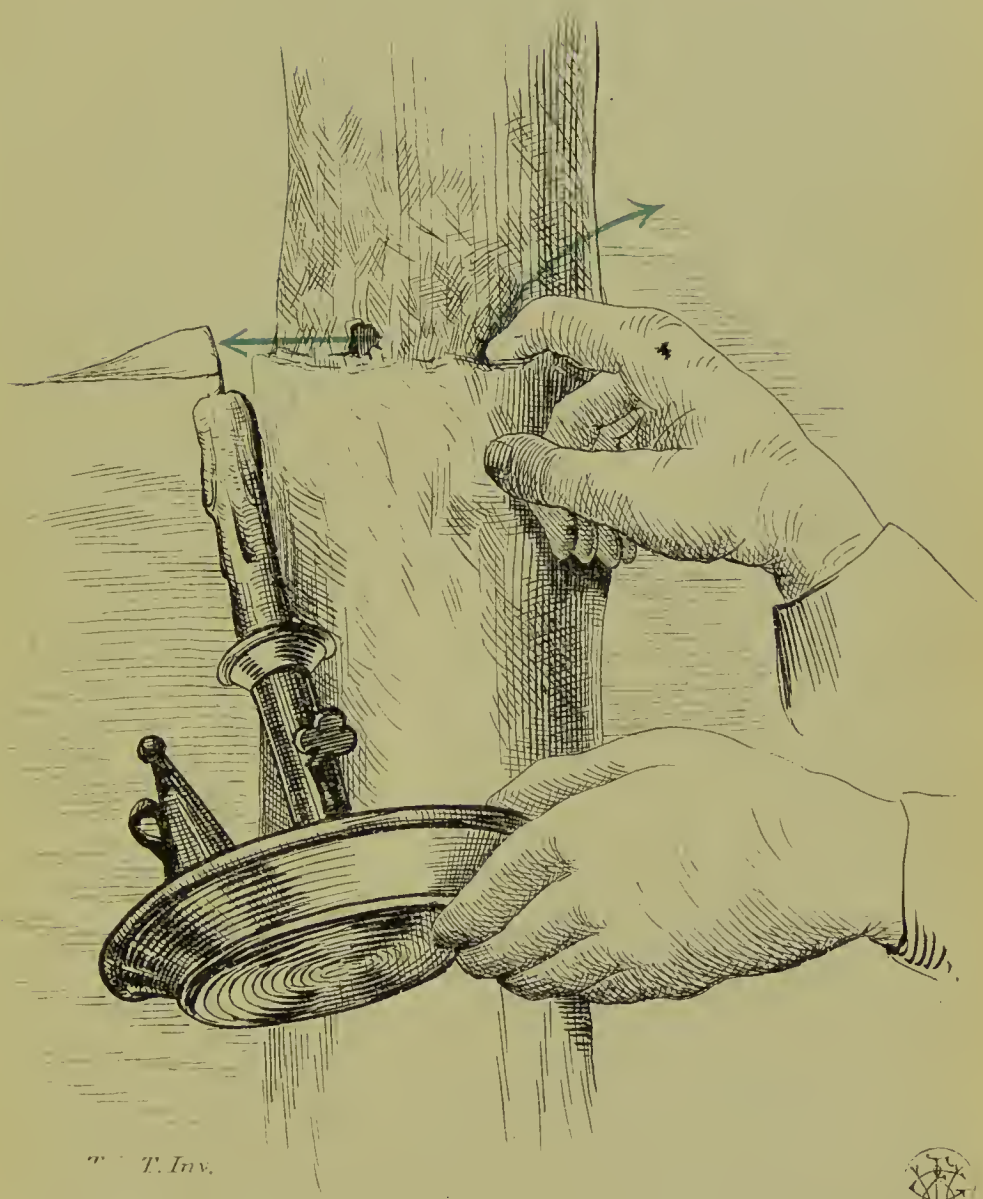
"Putty joints" in leaden soil-pipes.

This is scamped work. In order to save his pocket the plumber will sometimes save the cost of solder, and join the leaden soil pipes with putty and inferior material. The result is that the joint is insecure, soon gives way, cracks and gapes, and allows sewer gas to escape into the house.

A flaw in the joint can be detected by the current of air against the flame of a candle, and the quality of the material may be tested by its easily giving way to the finger or a knife.

Leaden soil pipes ought to be carefully joined together by solder, and to have no crevice through which air can pass.

PLATE XVIII.



"Putty joints."

PLATE XIX.

Leaden soil pipe, seamed, and crumbling with age.

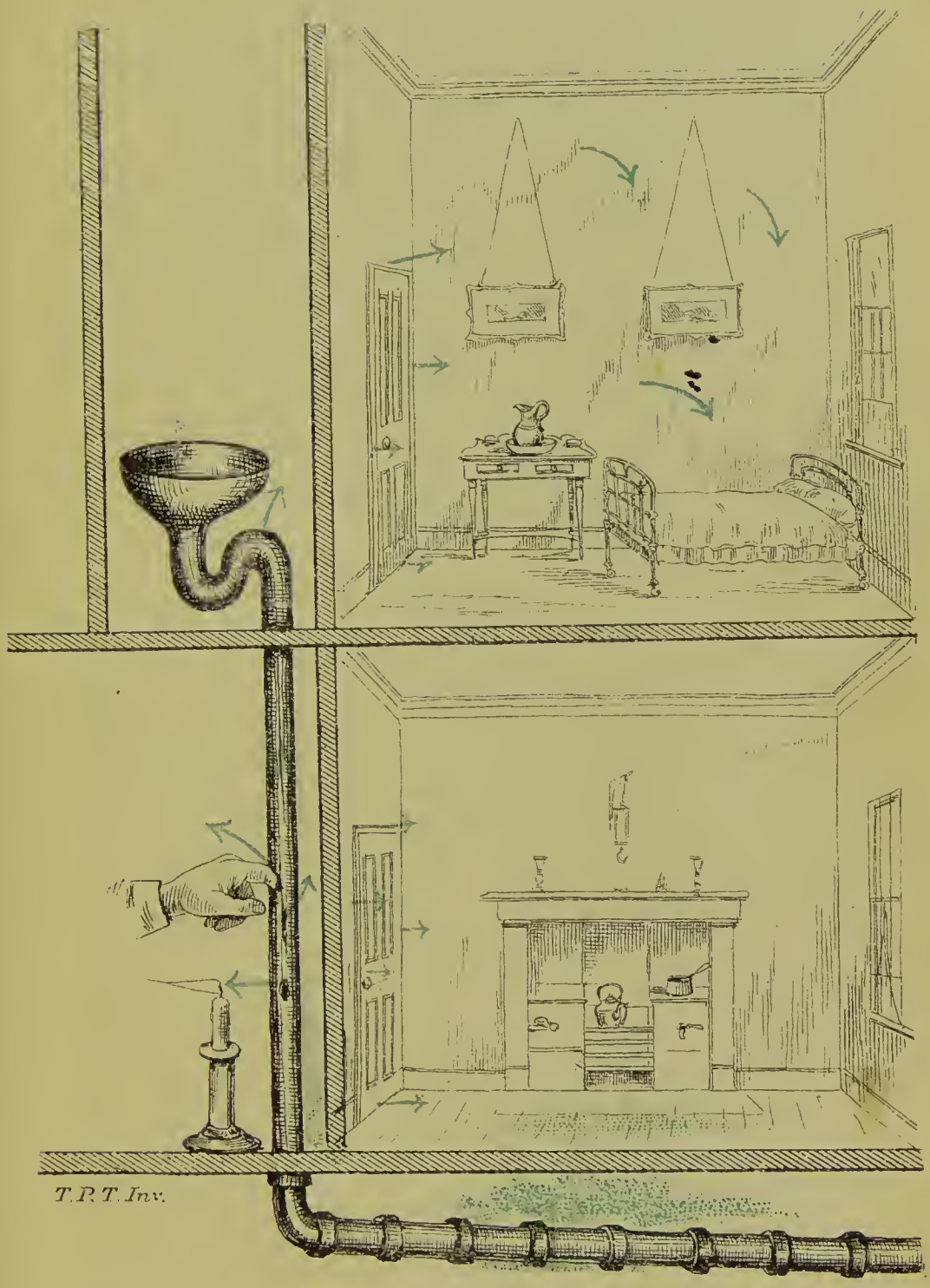
This was found in a house recently occupied by a relative of my own. An old water-closet, very little used, and situated in the centre of the house was condemned to removal. The plumber who removed it found the soil pipe so rotten that it "crumbled like short cake." It was open at the seam, so that not only gas, but liquid sewage had escaped and had made the contiguous wall, and the kitchen under which the w.c. drain ran "black damp."

The soil pipe of a w.c. if inside a house, (an arrangement better avoided,) ought to be made of *drawn lead, i.e., not* of sheet lead rolled into the form of a tube and soldered at the seam. A seamed pipe may be defective and leak at any point of the seam. A drawn lead pipe, if a good one, is only in danger of being defective at the joints, *vide* Plate XVIII., "Putty joints."

Age is a source of danger in leaden soil pipes. Dr. Fergus, of Glasgow, found that unventilated pipes of 15 years, and ventilated pipes of 25 years became eroded, eaten into holes, on the inner surface by the sewer gases, especially on the upper surface of a bend. Dr. Fergus considers that the duration of *ventilated* soil pipes is from eighteen to thirty or more years; of *unventilated* soil pipes from a minimum of eight years to a maximum of twenty years.

He has traced illness on many occasions to perforation from within of leaden soil pipes, which had been corroded by sewer gases.

PLATE XIX.



Leaden soil-pipe, seamed, and crumbling from age.

PLATE XX.

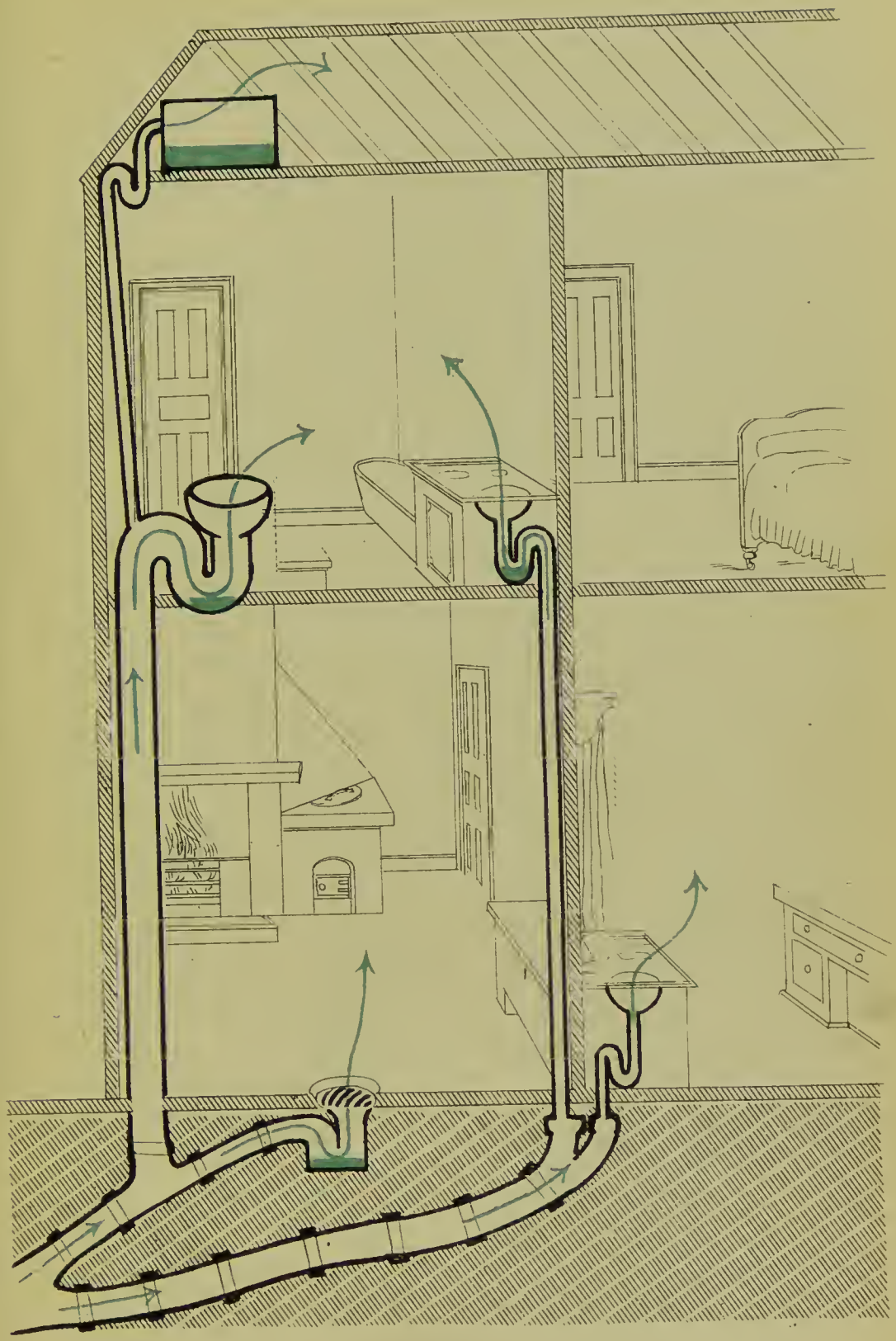
Disused Traps; Evaporation.

Traps cease to be traps as soon as the water evaporates below "the seal."

Unoccupied houses are liable to have open communications with the drains from this cause; and lavatories, and water-closets rarely used may become "unsealed" from disuse and evaporation.

It is not uncommon to hear people say, "oh we never use "such and such a w.c. except in case of illness," forgetting that disuse means evaporation, and open communication with a drain. Probably much illness has resulted from evaporation of the water in the syphon of a lavatory of a seldom used "spare bedroom."

PLATE XX.



T. P. T. Inv.

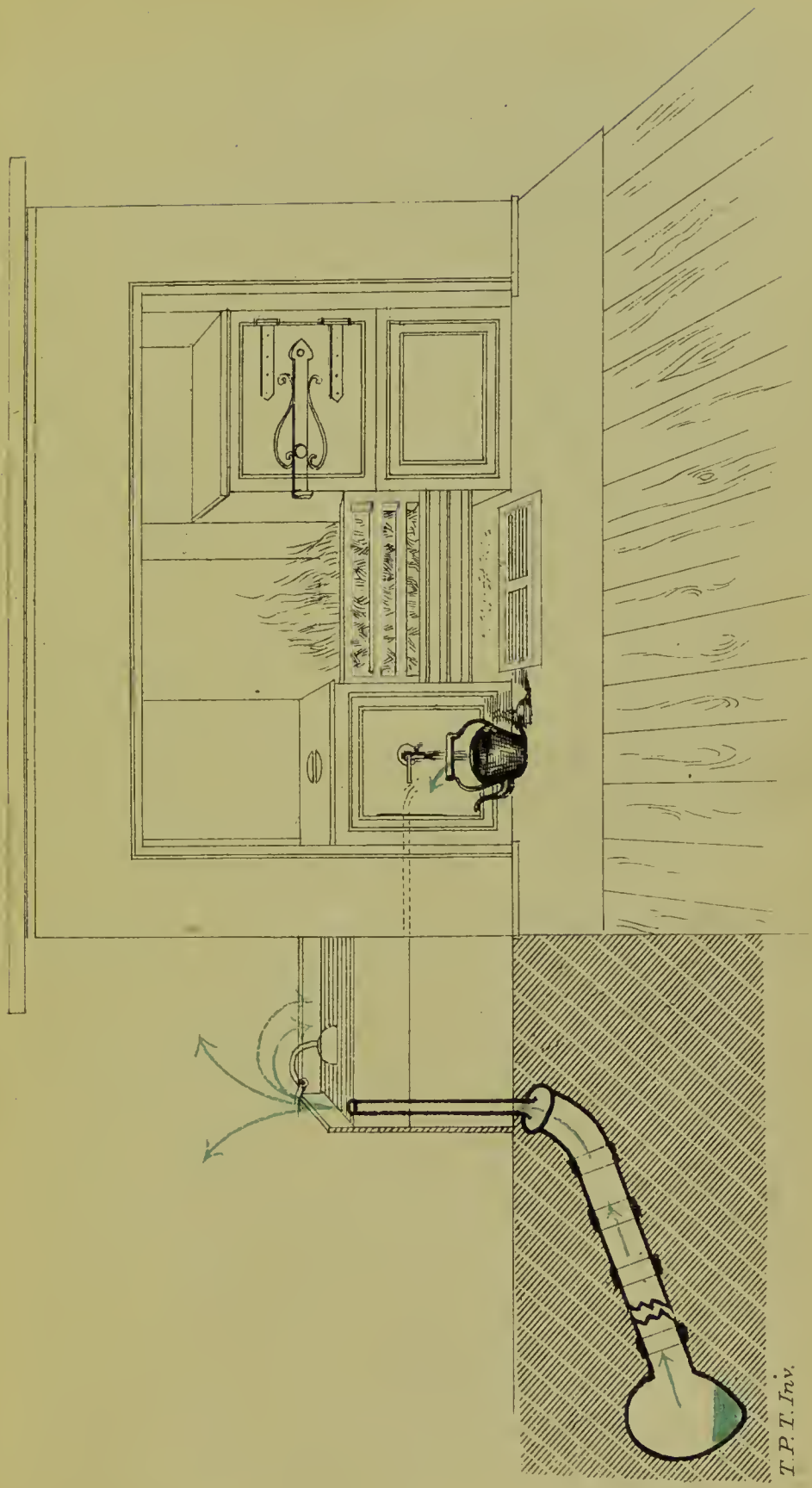
Disused traps, evaporation of water, direct communication with drain.

PLATE XXI.

Cistern feeding L boiler.

Where a cistern is arranged to feed a kitchen boiler, the cistern must have an overflow pipe. This overflow pipe is often carried direct into a drain without even the partial protection of a trap, and thus establishes a channel for sewer air to come into the kitchen, and to foul the water of the boiler. If water for the kettle be drawn for the boiler, then impure water is drunk.

PLATE XXI.



T. P. T. Inv.

Cistern feeding L boiler with overflow direct into drain.

PLATE XXII.

(A) Fall pipe communicating with sewer opening just below bedroom window. (B) ventilator of soil-pipe opening below attic window.

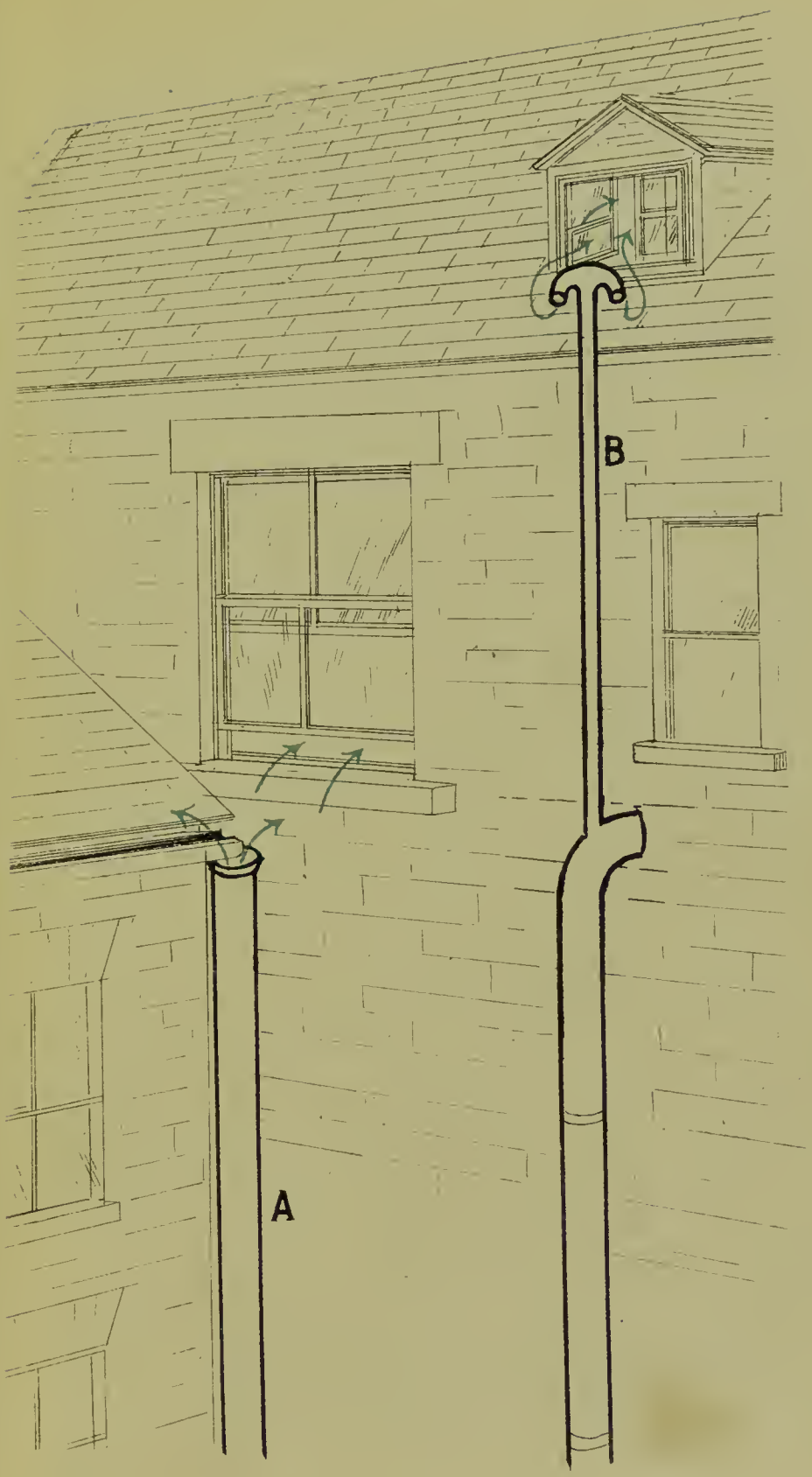
This is a not uncommon, though often an unsuspected source of danger. Some years ago, an outbreak of typhoid fever in one of the colleges at Cambridge was attributed to this cause.

Of the same class of faults are those arrangements common in London houses, in which a leaden roof over an outbuilding or bay-window, or a cistern outside a window, have fall pipes, or overflow pipes passing into drains.

A ventilating shaft from a drain ought not to end near the top of a chimney, lest the sewer gas be carried by a down draught through the chimney into the house.

This ventilating shaft is faulty in two points—(A) in not being as large as the soil-pipe, (B) in its termination. A trumpet-shaped opening, as in Plate I., being deemed the best.

PLATE XXII



T P. T. Inv.

"A" fall pipe communicating with sewer opening just below bedroom window.
"B" ventilator of soil-pipe opening below attic window.

PLATE XXIII.

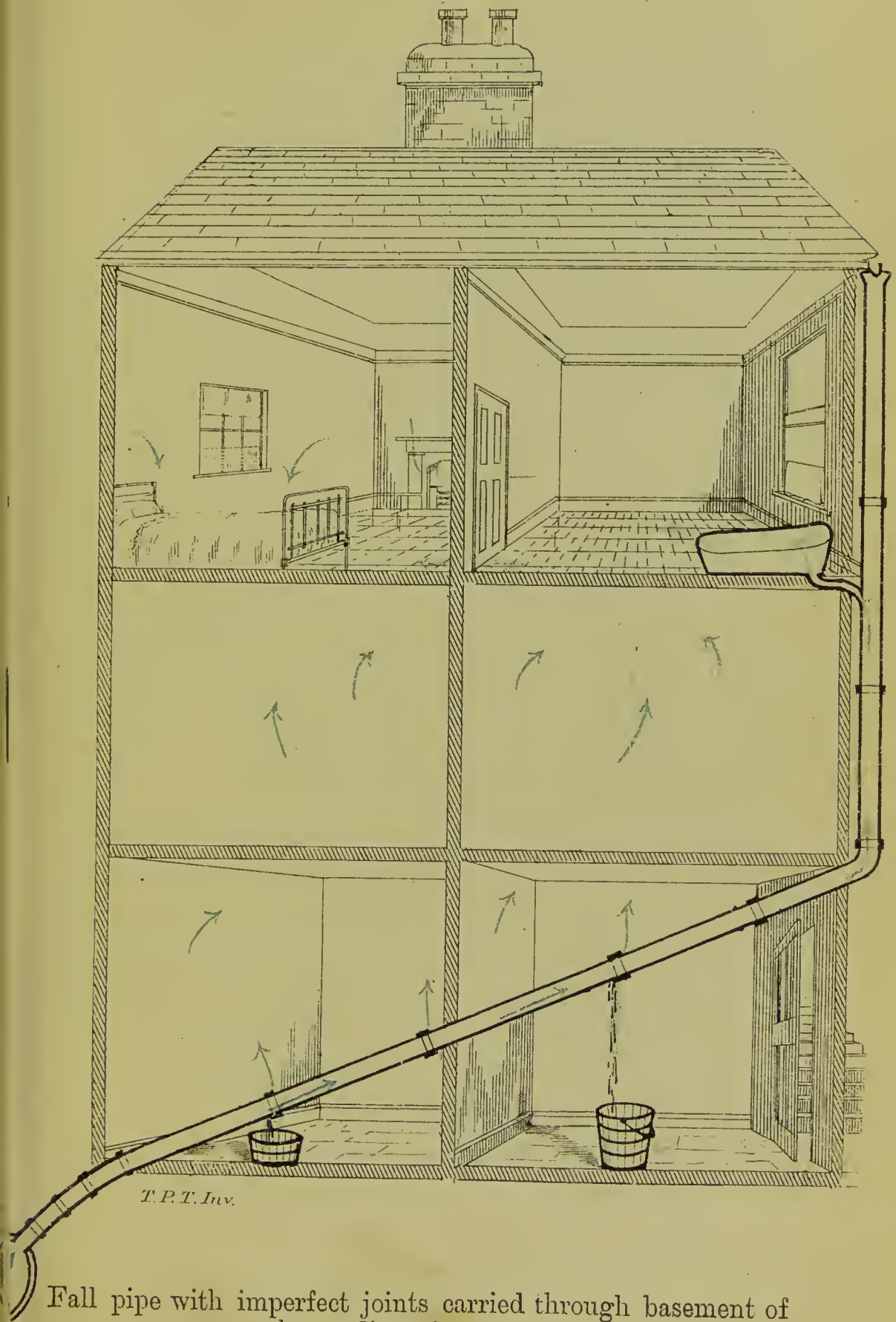
Fall pipe having direct communication with the drain carried through the house and allowing the escape of sewer gas from imperfect joints.

This house, at a watering place, was first tenanted and afterwards purchased by a relative of my own, who after a residence of a few weeks, had erysipelas of the face. This attack at once suggested to me drainage faults, and made me reproach myself for not having had the house previously inspected. An inspection discovered the rain-fall pipe carried from the the front through the cellars into a drain at the back. The joints of the pipe as it passed through the house were so defective that pans had to be placed to catch the rain. A bath upstairs had a waste pipe opening untrapped into the fall pipe. There was also an untrapped sink in the kitchen. After purchase of the house, the defects were remedied, and all pipes were disconnected from the sewer.

Mr. C. R. Chorley tells me that in one of the Yorkshire country mansions which he inspected, he found, along with numerous other faults, that *all the fall pipes had been carried, for the sake of appearance, inside the walls*, actually in the corners of bedrooms direct into the drains, and that the joints inside the house were incompetent and open, and allowed the plentiful escape of sewer gas.

Recently in my own consulting rooms, built for me 6 years ago, before I gave much thought to drains, Mr. Chorley discovered a rain-fall pipe carried through the centre of the house into a drain. The existence of this I had not suspected. The defect was remedied by conveying the pipe to a gully on the outside of the house.

PLATE XXIII.



Fall pipe with imperfect joints carried through basement of a house direct into a drain.

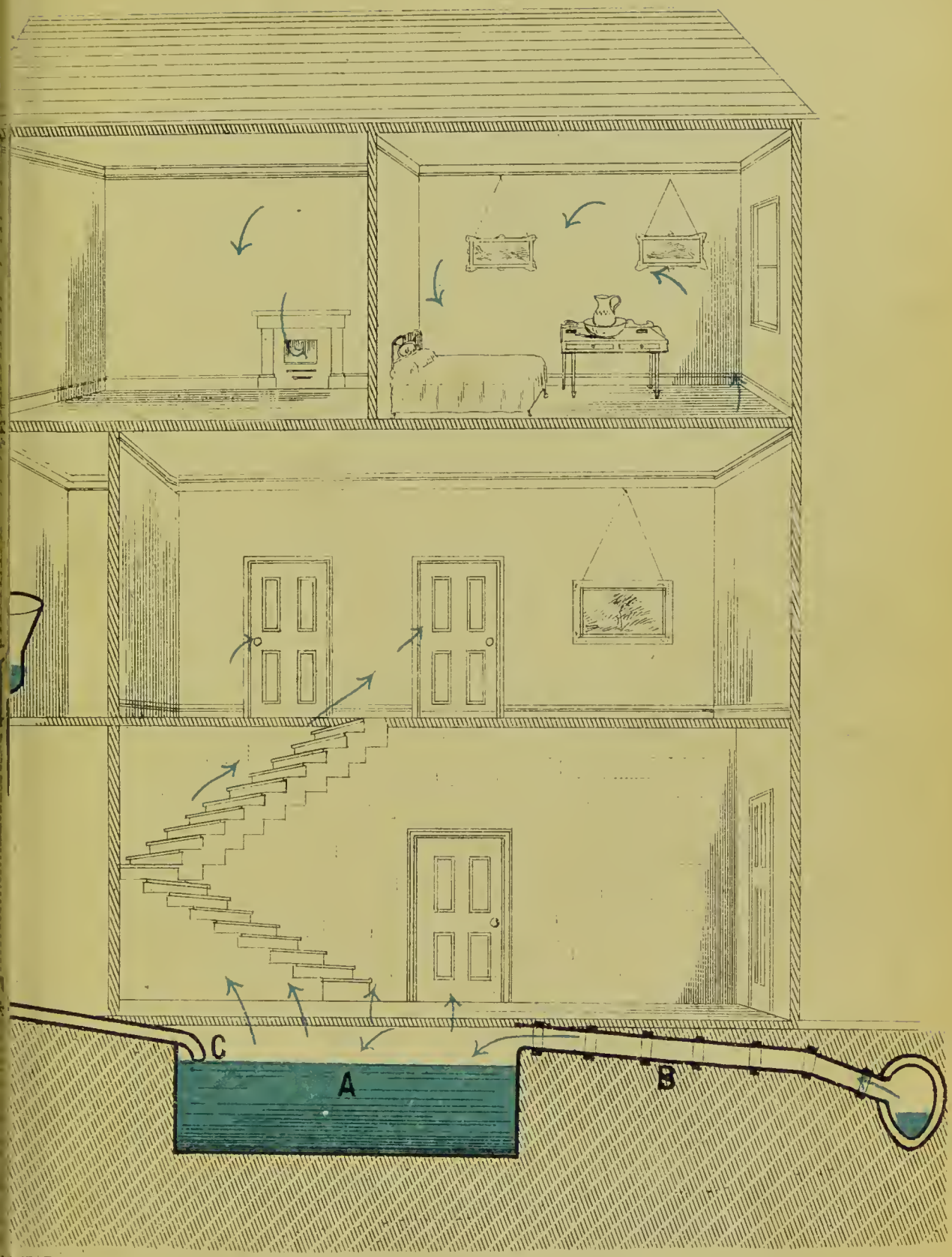
PLATE XXIV.

Disused and unsuspected water tank under cellar-floor.

This was found in the house of Mr. H. B. Hewetson, surgeon, of Leeds. Sometime previously, in consequence of illness in his family, he had removed a central w.c. to the outside, and had, as far as he could judge, corrected all sanitary defects. Illness of a typhoid character broke out, affecting Mr. H. himself and a maid servant. This led to a search under the cellar steps where the flags sounded hollow. A large unsuspected tank (A) was found, with direct overflow into the drain (B.) The end of the pipe of a long disused water-closet (C) was discovered at one corner. At the same time some other defects were found and remedied. Mr. H. recovered after a few days illness, and the servant lingered four months and then died.

Some improvement resulted from this change, but the house was not free from illness nor bad smells, until his next door neighbour allowed his house to be inspected, and the condition was found which is the subject of Plate XLV.

PLATE XXIV.



Rain water tank under cellar floor, overflow into drain.

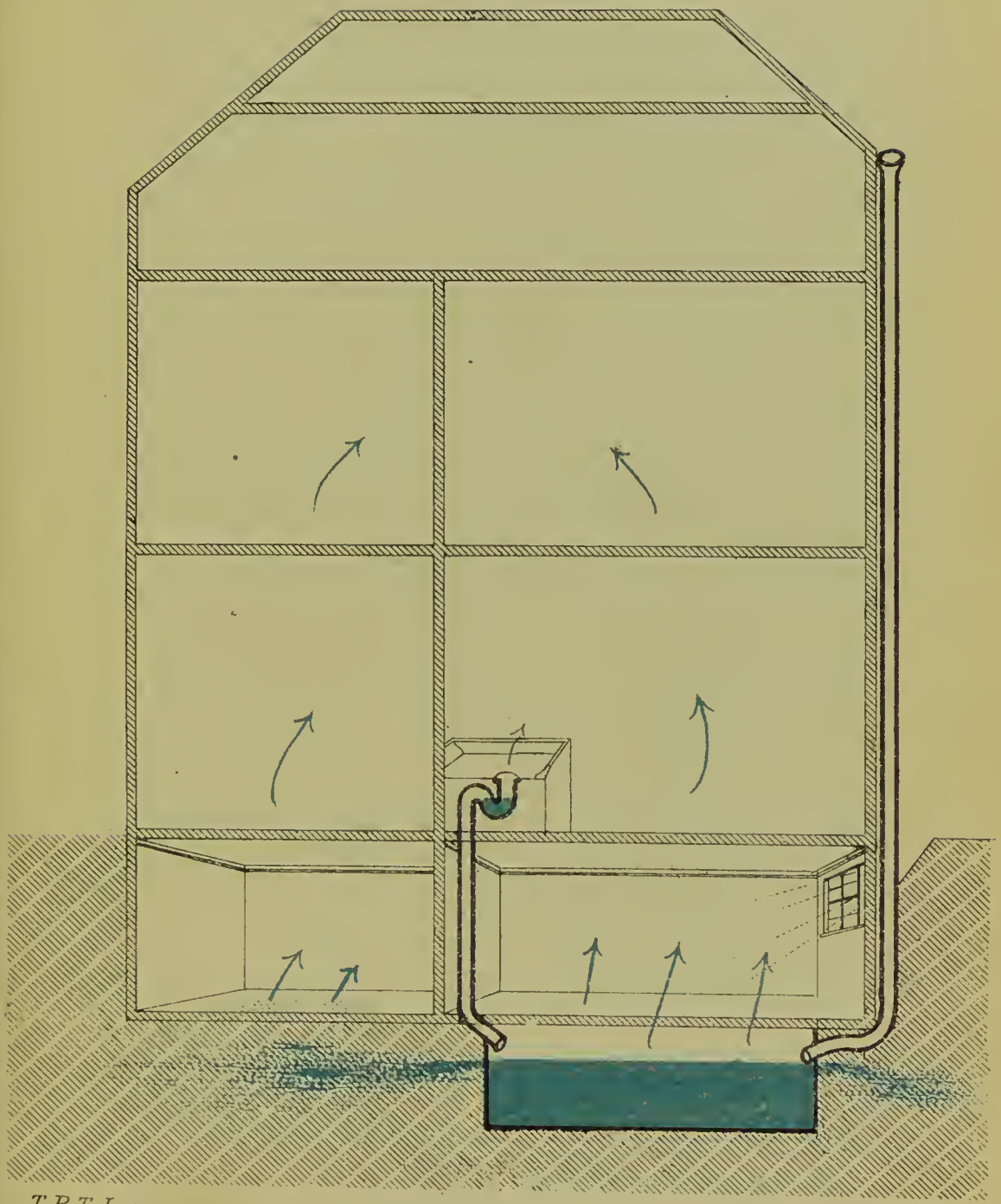
PLATE XXV.

Pantry sink turned into soft-water cistern under the cellar floor, with overflow into the rock.

Contributed by Mr. Atkinson, from his own house.—*Vide* Plates X. and XLI.

A large soft-water cistern was discovered under a cellar floor, full of very offensive water, which, having no overflow pipe, must have overflowed into the foundations. The cellars had been excessively damp, and had baffled costly attempts by his predecessor to remedy. Into this tank the slops from the butler's pantry found their way, as the waste-pipe of the sink had been turned into an old channel under the cellar floor which conducted rain from the fall-pipes into the tank. The butler's sink was one of the improvements preparatory to Mr. Atkinson's purchase.

PLATE XXV.



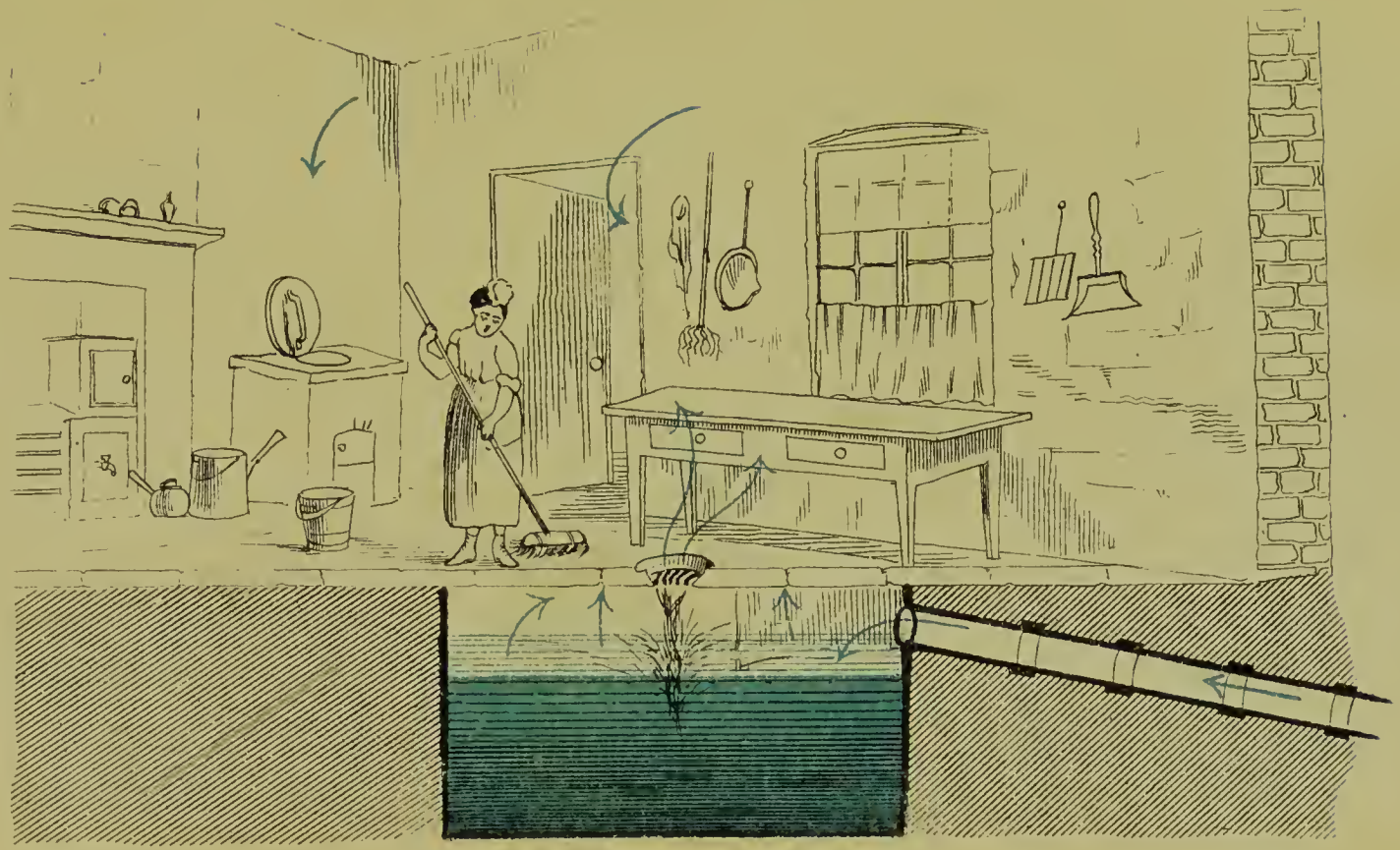
T. P. T. Inv.

Pantry sink discharging into rain water tank under cellar with overflow into rock, rendering the basement of the house damp.

PLATE XXVI.

"Dish-stone" in scullery leading into a rain-water tank with overflow direct into a drain.

This illustration, as well as Plates V. and XIX., was taken from the house of my relative. The servants were in the habit of washing the floor and sweeping the "washings" through the sink-stone into the tank. The tank had an overflow direct into the drain, and thus the sewer air had a free passage into the house.



T.P.T. Inv.

Dishstone in scullery untrapped and opening direct into a rain-water tank, with overflow into drain.

PLATE XXVII.

"Rats, and the tale they tell."

When rats appear in a kitchen or cellar the presumption is that they come out of a drain. A hole in a drain which permits the escape of a rat, will allow the sewer gas to be drawn into a house: "*pleno flumine.*"

When a waste-pipe or a sink joins a drain under a kitchen floor instead of discharging into a gully outside, this is what usually happens. The sink-pipe *religiously trapped* passes *neatly through the kitchen floor*. *Beneath the floor* and out of sight it passes into an open wide-mouthed drain pipe, 4 or 6 inches in diameter, with no cement nor luting whatever to bar the escape of rats or sewer gas. This piece of scamping being out of sight is *exceedingly common*, and is often overlooked by Inspectors who satisfy themselves with a peep at the syphon trap, and never think of the gaping pipe concealed beneath the flag, ready to let the rat out of the bag.

This was discovered in a house which I recently bought.

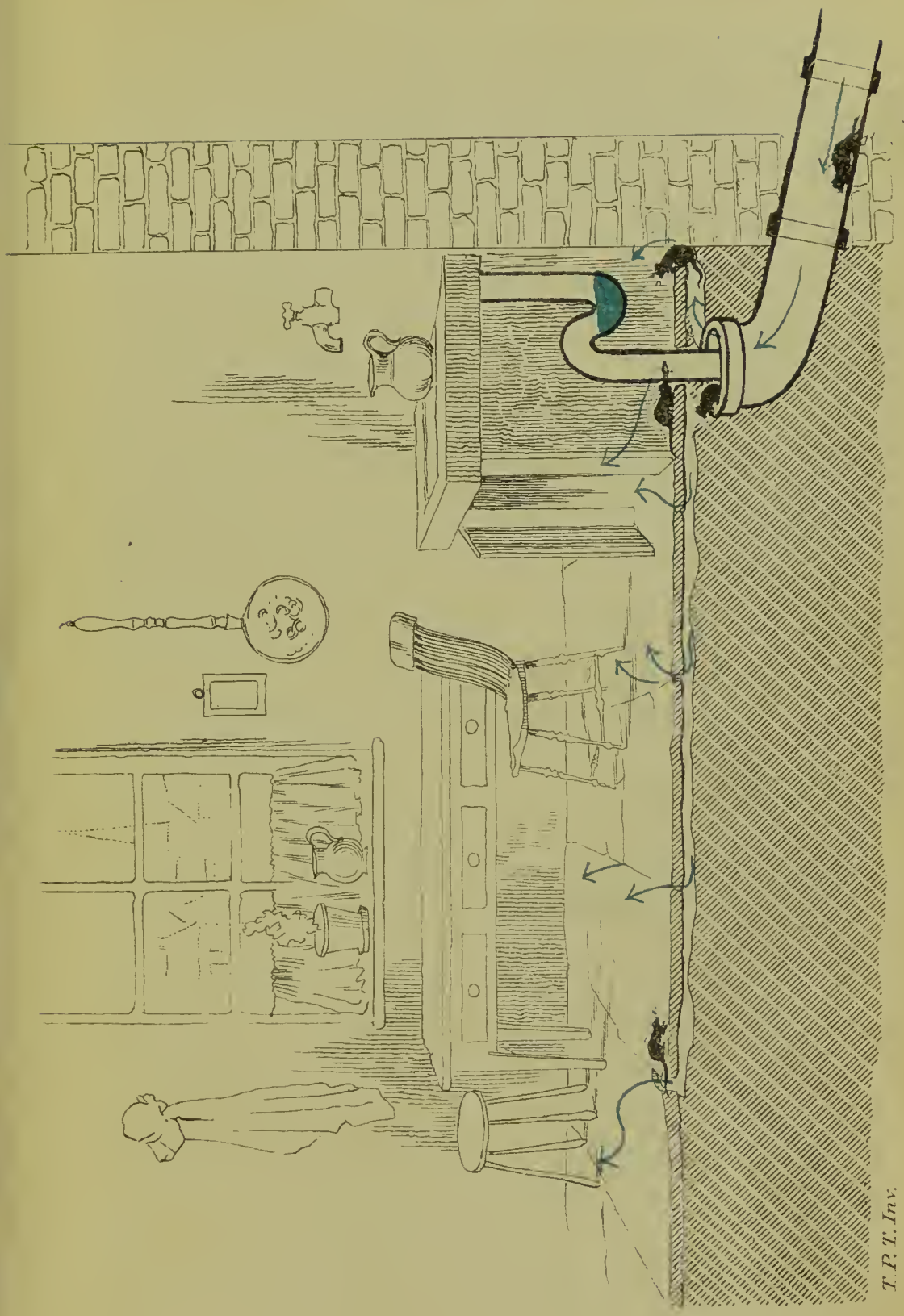
In my own kitchen also a flaw of this kind was found. The cement forming the junction of the sink-pipe and drain, was eaten or broken away, leaving a hole large enough to receive a man's hand.

I need hardly say that I had the sink-pipe turned into an outside gully, and the drain under the kitchen entirely removed.

In two other ways rats do mischief—one, by eating through lead pipes in order to reach water or fat—the other, by making runs under drain pipes and letting down and opening the joints.—*Vide* description of Plate XXX.

Open drain joints concealed under a cellar-floor can often be detected in the following way:—shut all windows and outer doors—open all doors between the cellar and the fires in the house—then hold a lighted taper opposite any crevices or fissures, such as are shewn by the blue arrows.

PLATE XXVII.



Rats, and the tale they tell.

T. P. T. Inv.

PLATE XXVIII.

"No wonder the meat wont keep, the beer turns sour, and the milk disagrees."

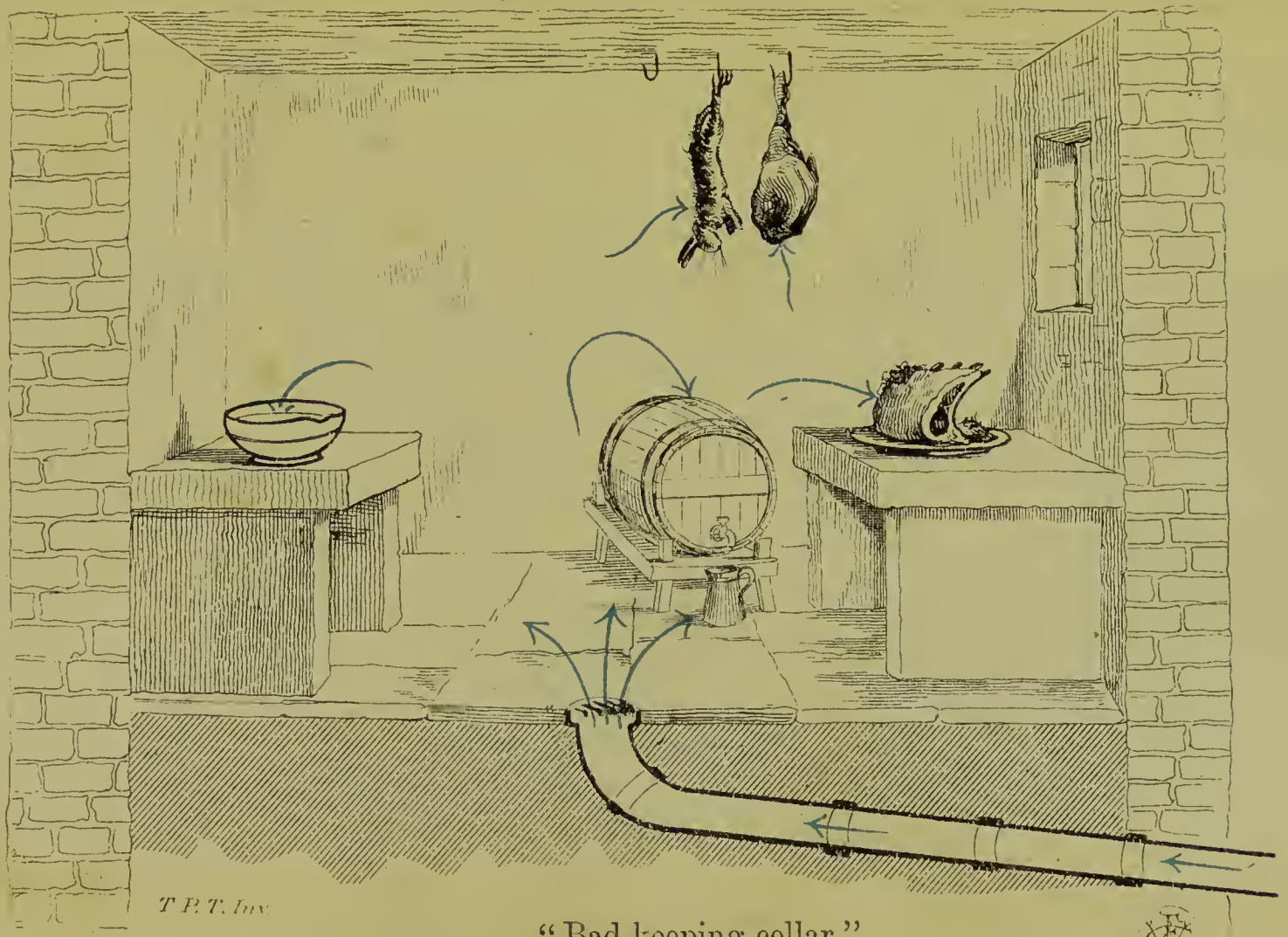
"Dish-stone in larder leading into a drain."

Open grates in cellars for the purpose of "swilling" the floor are not uncommon. They are often untrapped, and when trapped, the traps are usually ineffective from want of water, or from being broken; and even if sealed by water, they are still an inefficient barrier to sewer gases, which can pass by absorption through water.

In the dairy and larders of the new Leeds Infirmary there were found sinkstones practically untrapped in every instance.

It is probable that this communication with the drains may have been the explanation of certain outbreaks of diarrhœa in the Hospital which were attributed to the milk, but without any such source of its contamination being suspected.

About 3 years ago two boys were ill in low fever in a newly built country house. Every care had been taken about the drainage, and the drinking water was found free from pollution. The medical attendants were for a long time at a loss to find out the source of the fever, at last the milk was suspected, and the dairy at some distance from the house was examined. A sink-stone leading to an open drain was discovered.



"Bad keeping cellar."

"No wonder the meat wont keep, the beer turns sour, and the milk disagrees."

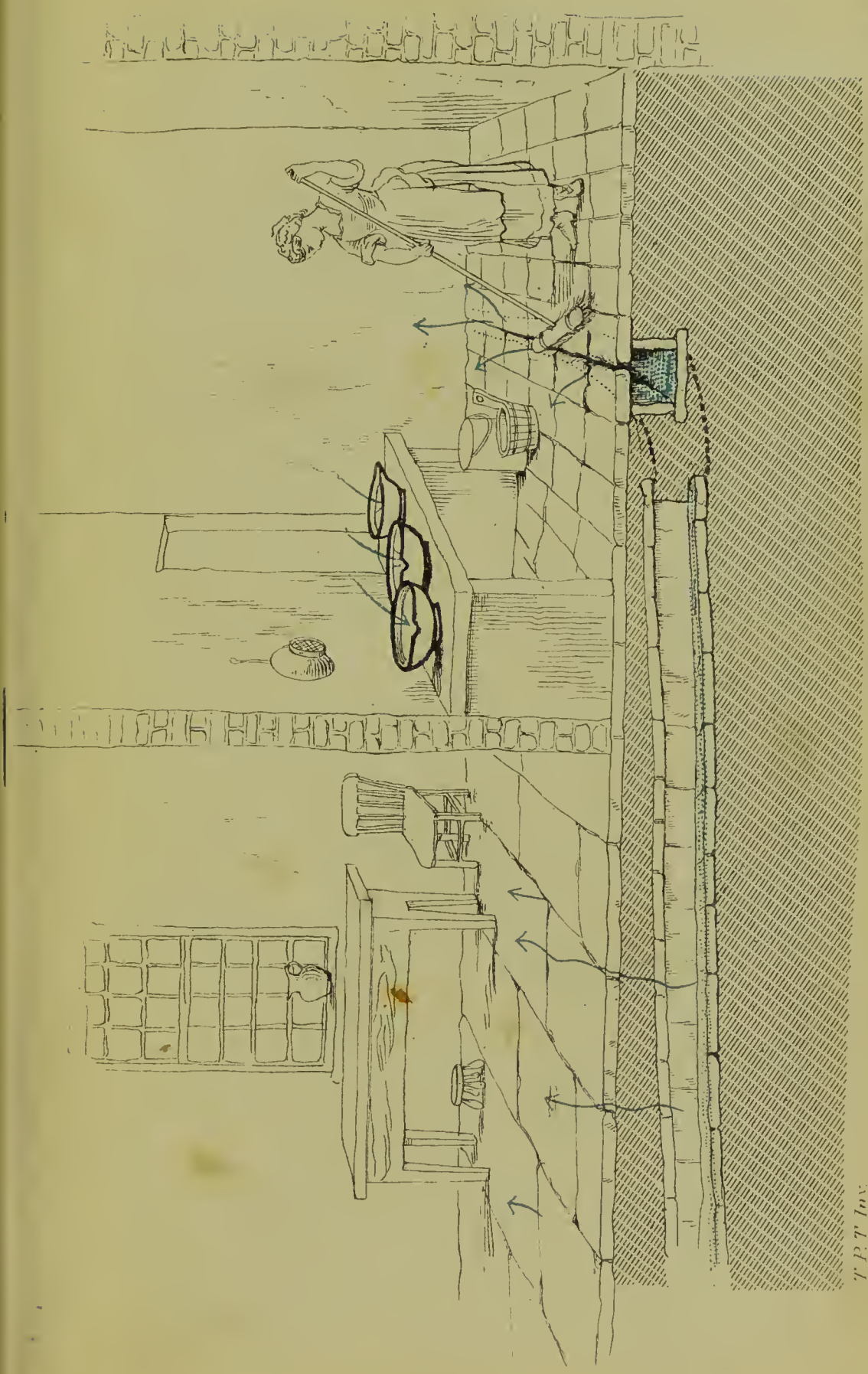
PLATE XXIX.

"Dairy Sweepings."

This illustration was contributed by Dr. Midgley Cockroft, of Masham, in the following letter:—

"I attended the family on two occasions. In the first the "type was purely Typhus,—four cases, one death. On the "second attendance the type was entirely Typhoid; all had "diarrhœa, all had rose spots, and one death occurred in the "four cases, three of the cases having gone through the first "illness. There was no other case of either variety in the "neighbourhood. I had a good opportunity of watching the "process of cleaning down the dairy. The joints in the "flagging were purposely left about ¾ of an inch apart in "order that the water thrown on could easily be *brushed into* "*the fissures* whence I could hear it falling into a drain below, "which drain only went from the dairy into a garden in front "of the house, a distance of about 10 or 12 yards with a very "little fall in its course. The house was a very old one, and "has now been replaced by an entirely new one. I may add "that the dairy floor was 'dished' to facilitate the discharge "of the water." It would seem that the spilt milk, washed into the imperfect drain, underwent a poisonous decomposition in the drain, and thus gave off poison to the dairy, milk, and kitchen.

PLATE XXIX.



"Dairy sweepings."

T. P. T. Inv.

PLATE XXX.

How people drink sewage.—No. 1.

Drain pipes badly joined or broken, leaking into a well.

This is the condition probably of a large proportion of the wells of the country, especially of the shallow surface wells.

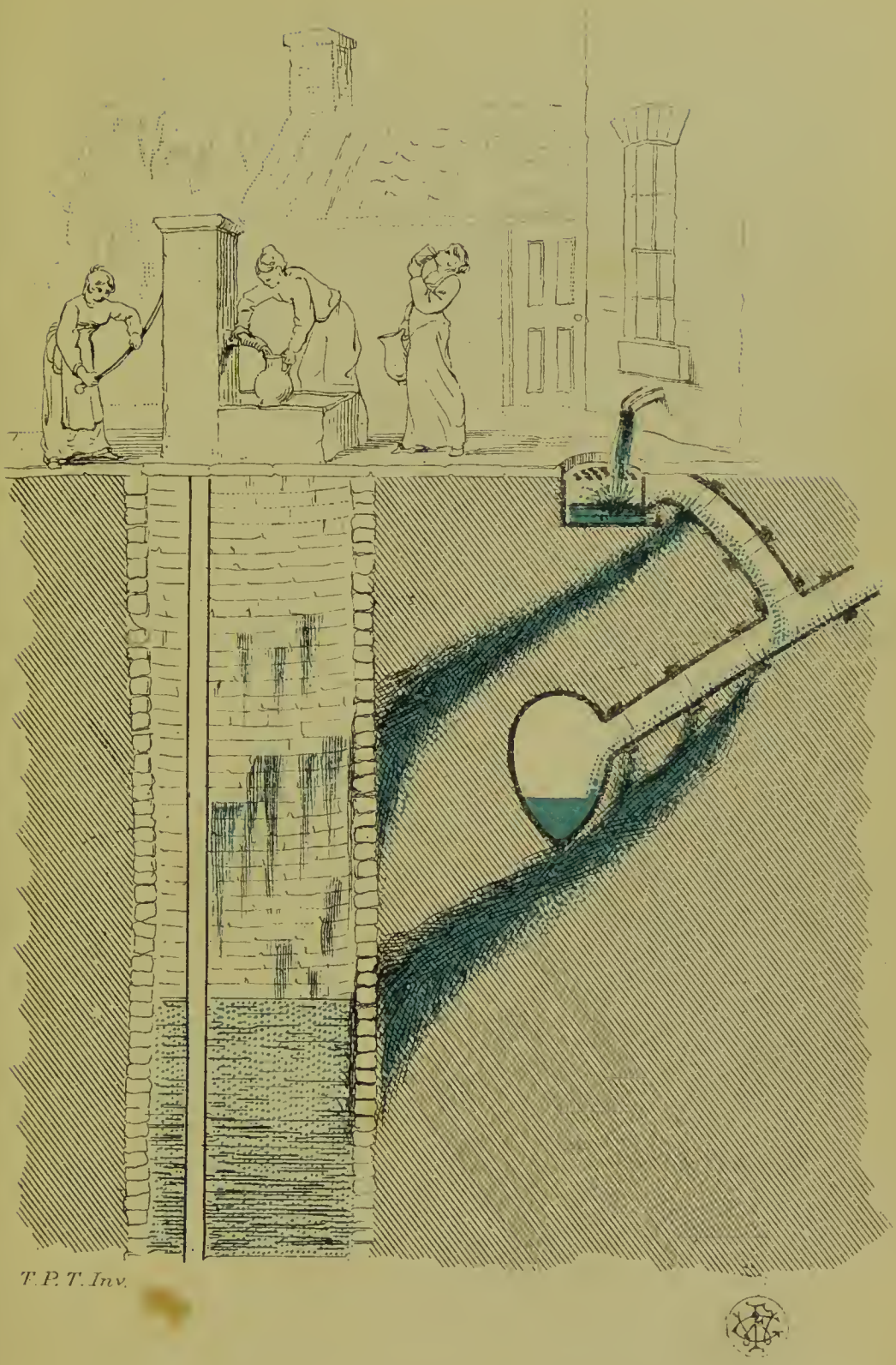
A glance at the picture will convince most thinking persons of the pressing need there is for a great national organisation for providing wholesome drinking water to villages and small towns which do not as yet possess a public unpolluted water supply. This need has been pressed upon the attention of the public by the press, the Society of Arts, and by His Royal Highness the Prince of Wales.

A well may be polluted with sewage for a long time before illness results.

The history of the outbreak of typhoid fever at Bramham College about *ten years ago* is almost classical. By judicious care and outlay the health of the boys in this school had been long preserved at a high level. But on the reassembling after the holidays a boy fell ill of typhoid fever contracted at home. He was placed in the "sick-house," and used the w.c. which discharges into a drain running near the underground cistern which supplied the drinking water. In a fortnight about 30 boys were down with typhoid. A careful investigation made by the proprietor and Mr. Ellerton, and reported on to the Local Government Board by Dr. Clifford Allbutt, revealed a leakage from the drain, and a fouling of the cistern thereby. Both cistern and drain had been very carefully and properly constructed, but the drain lay too near the cistern, so that when a joint of the drain was let down by a rat run, the escaping sewage soaked through some fine crevices in the cement of the cistern.

In this instance, water fouled by drainage did not set up typhoid fever until the importation of case of typhoid led to the introduction of typhoid discharges into the drinking water.

PLATE XXX.



How people drink sewage.—No. 1.
Drain leaking into a well.

PLATE XXXI.

How people drink sewage.—No. 2.

Cesspool full and overflowing into a well.

This is the same in principle with the last picture, and teaches that cesspools need constant attention and cleansing, and very great care in construction. (Building bye-laws, § 35—§ 39.)

The following illustration came before my notice. Typhoid fever broke out at a farm house, distant about half-a-mile from a village. The father died, and the mother and daughter recovered. In the village the only case of fever which occurred was that of the farming man who had his meals at the farm and went home to the village to sleep.

The following was supposed to be the cause of the fever. Ten feet from the door of the house there was a cesspool. Twelve months previously a well had been made between the house and the cesspool. Shortly before the time of the fever the house drain had become so offensive that the cesspool was examined, and was found to be full and overflowing, and was in consequence emptied. It is a fair inference that the cesspool had overflowed into the well and poisoned the drinking water. This occurred some years ago, and the well-water was not analysed, so that complete proof was absent.

Nevertheless the picture generalises well known and well ascertained facts.

How people drink sewage.—No. 2.
Cesspool full, and overflowing into a well.

PLATE XXXII.

Cesspool overflowing and causing the floor and wall of a house to be damp from sewage.

This illustration is a general expression of the following facts, rather than a representation of any actual example.

Case 1 was related to me by Dr. James Braithwaite, as having occurred in a suburb of Leeds about 2 years ago.

Typhoid fever occurred in two of a group of three newly built houses, within a few weeks of their being occupied. The following conditions were discovered when *a few months after*, the main-drain was brought within reach, and an attempt was made to connect them. The drain from No. 1 and 2 opened into the drain of No. 3, and this terminated 18 inches from the house, forming a cesspool in the soil which rested against the cellar of No. 3, and in rainy weather caused the cellar floor to be flooded. Typhoid fever broke out in No. 3, and afterwards spread to No. 1.

Case 2. A young woman was suffering from chronic sore throat and partial loss of voice, a serious matter, as she was being trained as a public singer. Having enquired into the sanitary condition of her house, I learnt from her mother that two children had died of diphtheria, and that the kitchen floor was damp and offensive from the overflow of their cesspool. Complaints had been ineffectually made to the landlord's agent, but her husband dared not complain to the landlord, his master, for fear of being dismissed from his situation, that of head gardener.

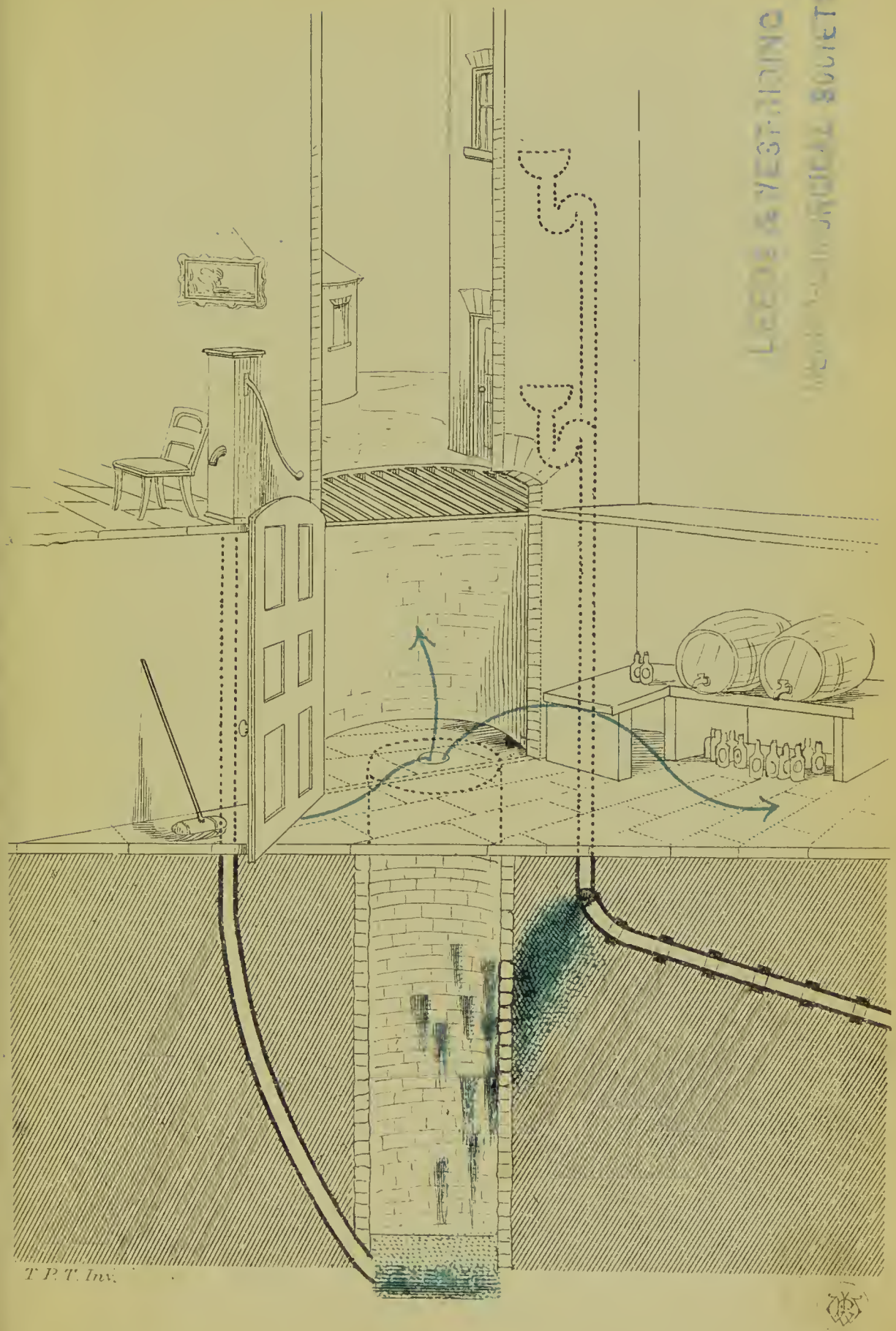
Cesspool overflowing under house—hall and floor damp.

PLATE XXXIII.

Broken junction of drain with soil-pipe, leakage into disused well under keeping-cellar.

This fault was discovered in a house in Park Row, formerly occupied by myself, but now used as offices. About a year and a half ago, complaints were made of bad smells in the house, and some of the inmates were unwell. On inspection it was discovered that an old disused well partly under the keeping-cellar was becoming a cesspool from leakage through its walls from the w.c. drain. This drain had become defective at the junction of the vertical soil-pipe with the horizontal drain. It appeared that the *soil-pipe had settled, and by its weight had broken the flange of the drain-pipe*, causing the sewage to flow into the rock underneath the cellar floor, and so into the well. The drain-pipes were repaired, and the well was filled up. The office keeper told me that before the fault was discovered "she hardly ever "passed a week without a sick headache, that her children "were constantly ailing, and that she could keep neither meat "nor milk. Since the fault was corrected they have been in "good health, and the meat and the milk have kept well."

PLATE XXXIII.



Broken junction of drain and soil pipe, and fouling of well under a house.

PLATE XXXIV.

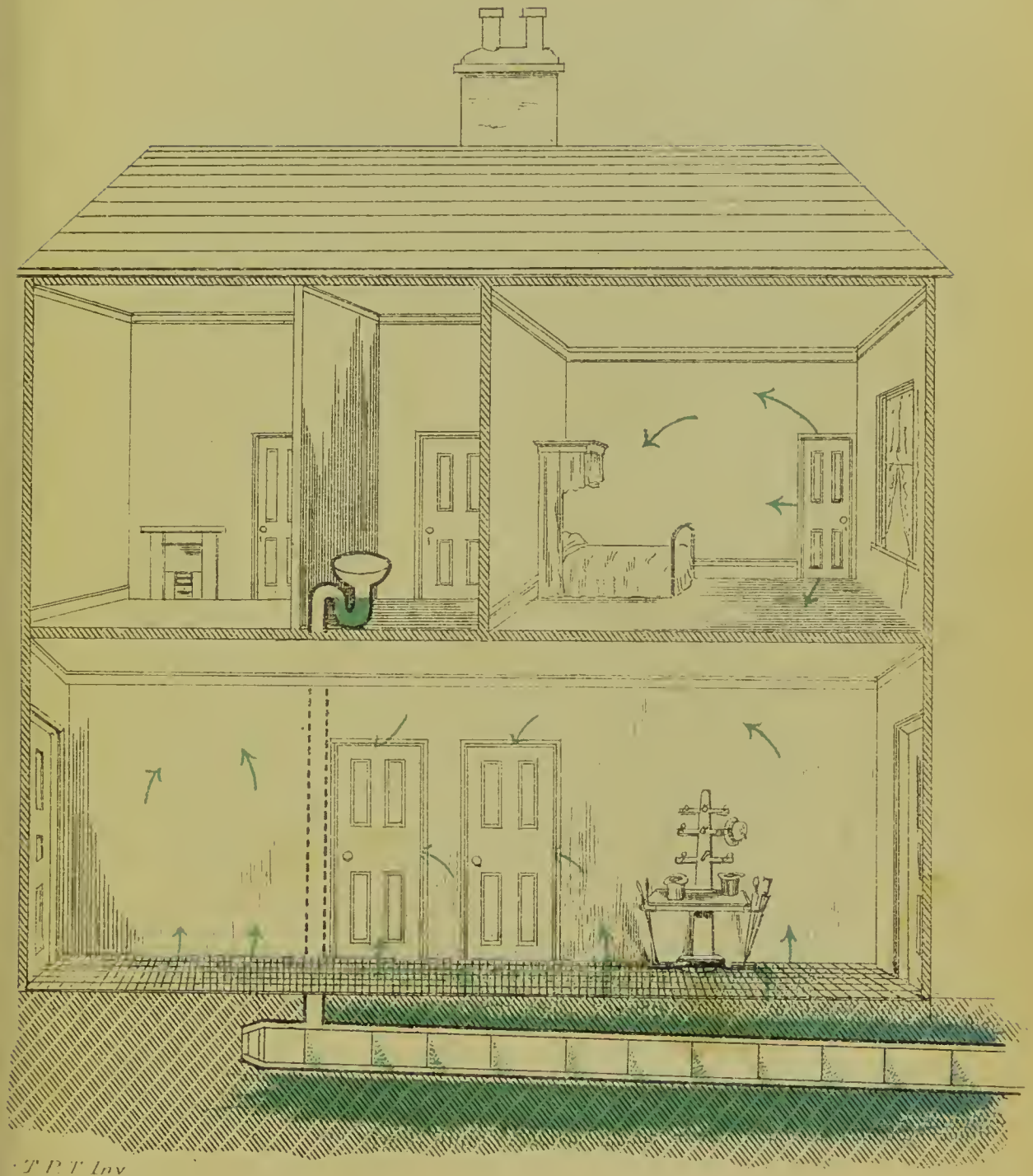
Common stone drain under tiled entrance hall, leaking at every joint, and forming an extensive cesspool under the house.

This example was communicated to me by Dr. Britton, medical officer of health for Halifax and district, in the following note:—

"Enteric (typhoid) fever broke out in a gentleman's house, "from which it spread into the village. On examination I "found that the w.c. was *in the centre of the house*, and that "the soil-pipe discharged into a common stone drain running "under a *tiled* entrance hall. This drain was almost without "fall, so much so, that it had become blocked, and the *sewage* "*had found its way under the flooring of the passage and rooms.*"

It goes to a man's heart to take up a tiled hall in order to inspect a drain. *Moral.*—The drain ought never to have been placed under the hall.

PLATE XXXIV.



Common stone drain under tiled hall, leaking at every joint, and forming a large cesspool under the house.

PLATE XXXV.

Speculating builder buying "Seconds."

On one of the occasions of the delivery of my lecture in a suburb of Leeds, one of our leading builders stated that it was well known by the building trade that dishonest builders of cheap houses were in the habit of buying "Seconds" sanitary tubes, *i.e.*, rejected broken tubes, at half price, in order to lay them in the houses they were building, in obedience to the law requiring them to lay a drain. Such tubes are defective either by fracture or by being mis-shapen, oval instead of round, or *vice versa*. Each such defect would allow a leakage, and the formation of a cesspool at the faulty point. In drains, as in chains, the value of the whole drain is determined by the value of its weakest point, and if at the weakest point there is a leakage, the whole drain may be worthless and disastrous.

If this picture has the effect of gibbeting such scoundrels, and making scamped drain-work less feasible, it will have served its purpose.

"'Jeremiahs' buy 'seconds' because they can't get "'thirds,'" said an honest Yorkshireman on seeing this picture.

"Jerry veal" is the flesh of calves which have been born dead, or have died soon after birth—an "article of commerce" in former days.

"Jerry builder" buying "seconds."

PLATE XXXVI.

Drain made of "Seconds" tubes.

Here are seen the results of scamped drain-work and cheap "Seconds" pipes. Such pipes are used mostly for the outside drains of cheaply built cottages and houses, and are sometimes found inside a house.

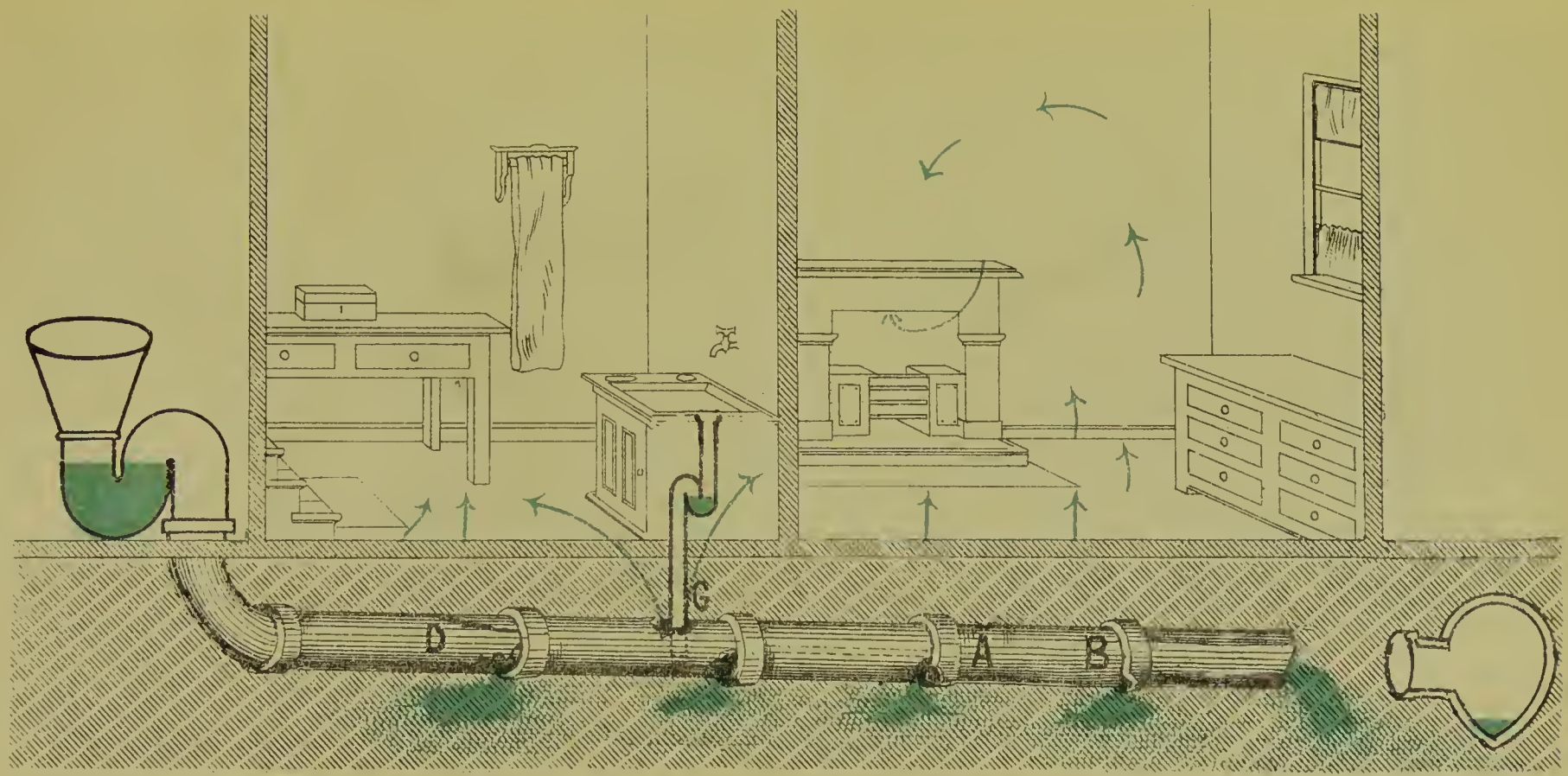
The pipes AA. are broken at the flange, BB. at the smaller end, and FF. are mis-shapen, spoiled in the baking, oval instead of round. Each of these defects renders a sound joint impossible.

C. has a fissured surface, D. has been broken and pieced together, a condition of pipe which Mr. Burton, the lithographer of this book, himself witnessed in his own house, and which he has drawn '*con amore*.' The workman declared that he could not afford to put in a new pipe.

G. shews careless connection of a waste-pipe. Instead of a tube with a proper junction as part of its construction, a hole has been broken into the tube, and the lead pipe passed through without luting. Moreover, the waste-pipe projects so far into the drain-pipe as to form an obstruction to the proper flow of sewage.

A drain formed of imperfect tubes with unluted joints, and insufficient fall, was found under the house of Mr. Carter, dentist, in Park Square. The soil under the floor of the kitchen was saturated with sewage, and the villany was rendered complete by the entire omission of a pipe for connecting the drain with the main-sewer.

Mr. Carter, by his removal into this house, got "out of the frying-pan into the fire." He had left his previous residence in consequence of "drain-begotten" illness in his family, and because of the rats which he had shot with an air gun by the dozen in his kitchen.



Drain made of "seconds."—Manslaughter under an "alias."

PLATE XXXVII.

Road scrapings, and ash-pit refuse for mortar and plaster.

This picture represents what has been, I fear, only too common an occurrence of late years in Leeds. Road scrapings from our Corporation depôts, and the emptyings of common ash-pits instead of loads of clean mill cinders, have been ground up along with a bare pretence of lime, to make the mortar for setting the bricks, and the plaster for covering the walls of miserable tenements.

This mud-made mortar sets so slowly, that the builder has to prop the wall, (this I have seen,) and, as I have often been told, has to light fires against the wall to "encourage" the mortar to set.

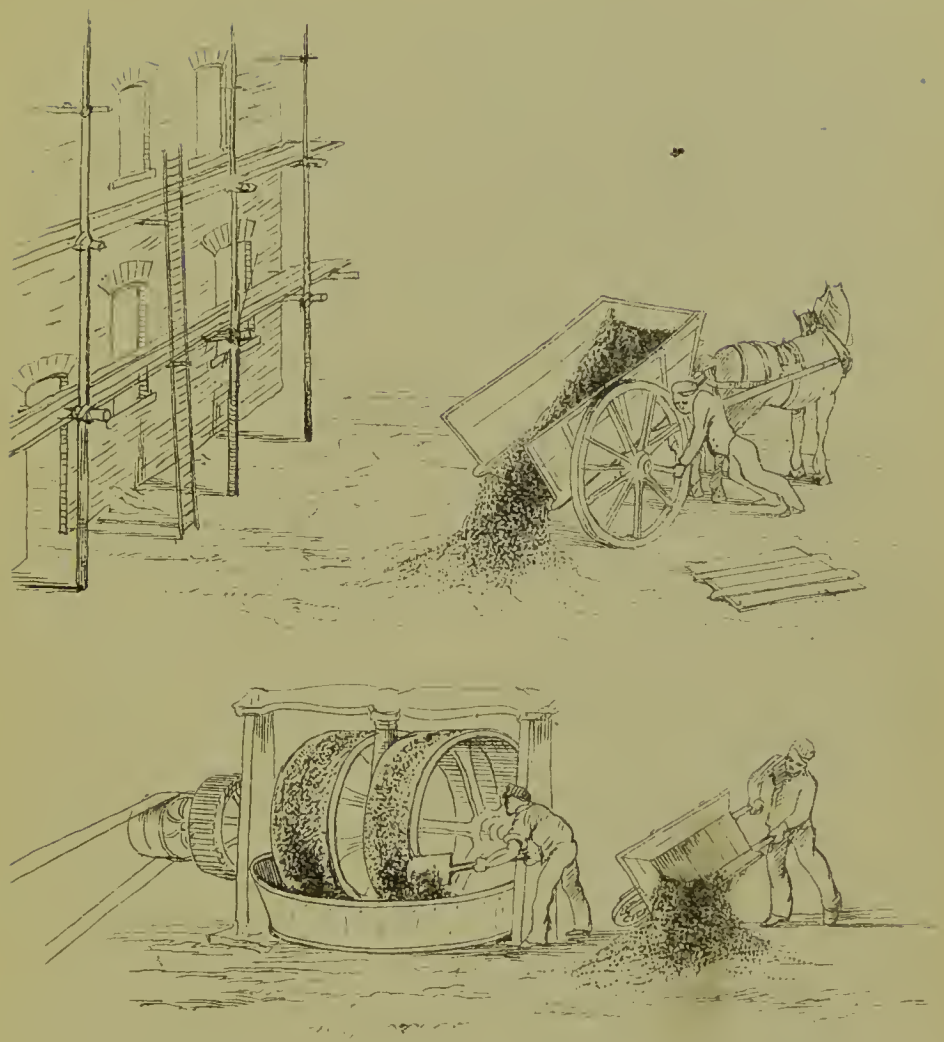
Walls plastered with such rubbish are slow in drying, have large greasey patches which strike through whitewash, crumble when a nail is driven into them, and probably are a prolific source of the illnesses from which people suffer who inhabit newly finished houses.

"If you bray a nail into the wall half of it comes down"—said a Leeds victim, suffering from disease of lung, probably brought on by the unwholesomeness of the walls of his house.

The following fact was told by a leading Leeds builder to the gentleman who related it to me :—

"In about 60 new 'speculators' houses not a single load "of clean lime was used—mortar and plaster were made of "lime which had done duty in tan pits"—therefore spent, and full of animal cleansings. The owners were the builders of the houses.

PLATE XXXVII.



T. P. T. Inv.

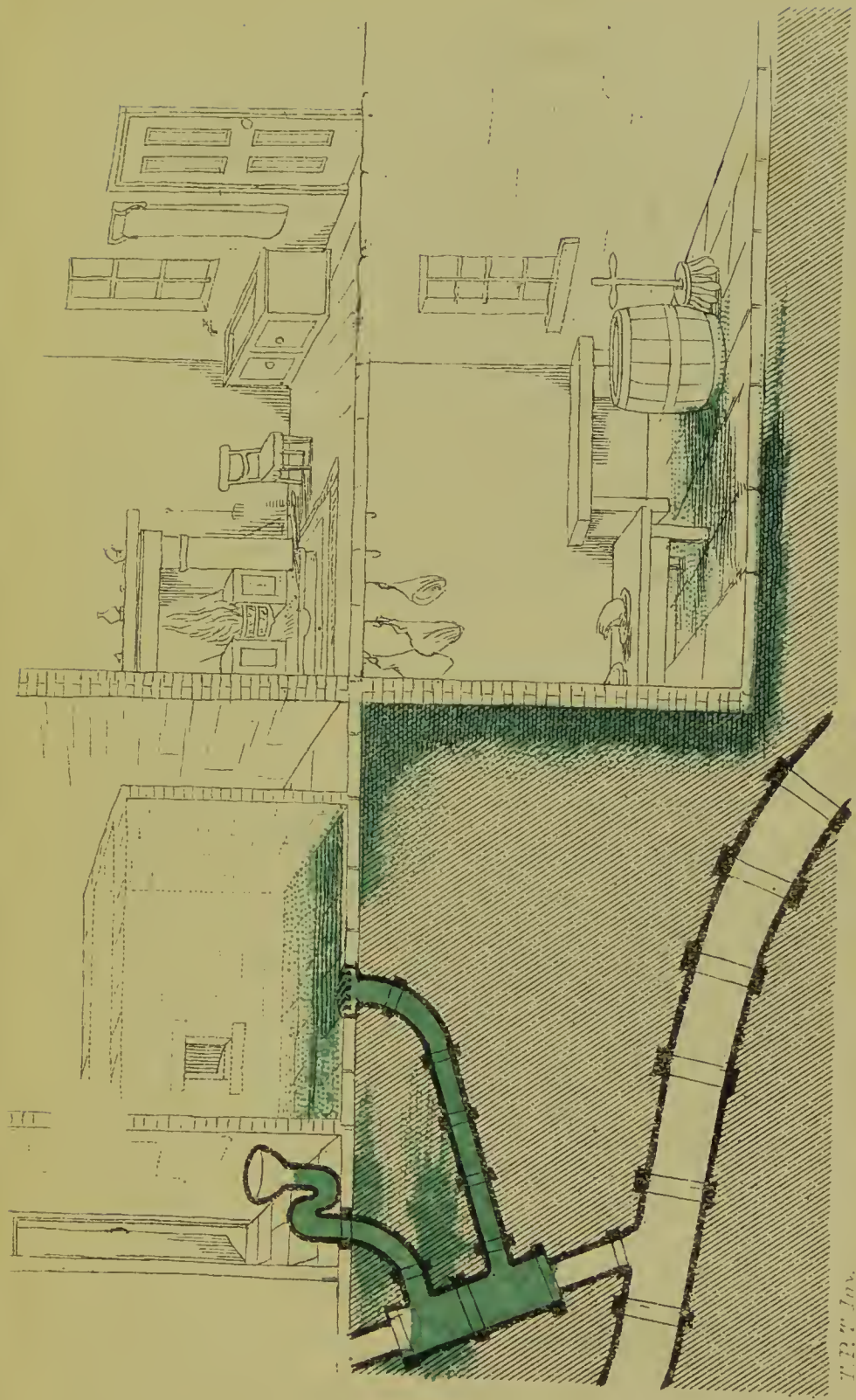
"Road muck" and "midden refuse" for mortar and plaster.

PLATE XXXVIII.

Six-inch pipe interpolated between two four-inch pipes.

This was discovered in some property which I recently bought in Portland Crescent. A cellar of one house was flooded by the overflow of an ash-pit, the drain of which was blocked up. The drain was followed, and traced to a junction with the w.c. drain of the next house. On enquiry, I found that this w.c. had long acted imperfectly, and, no wonder, as the drain was blocked up for six feet owing to the interpolation of a 6-inch between two 4-inch pipes.

PLATE XXXVIII.



6-inch pipe between two 4-inch pipes.

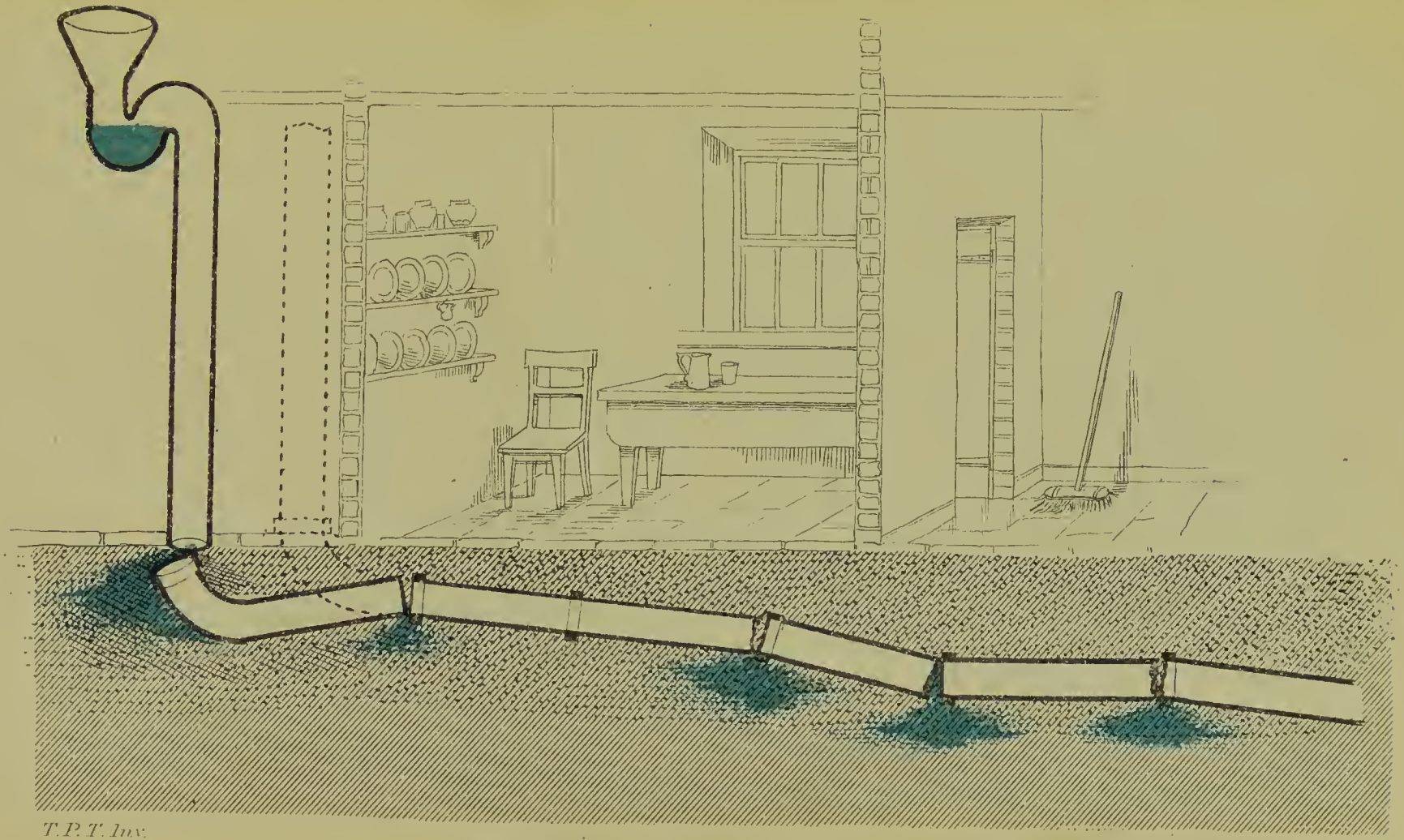
PLATE XXXIX.

Joints opened by giving way of foundations.

"When drains are laid in new made ground, unless care be "taken to ram the earth sufficiently hard round about them, "and this is next to impossible, the pipes will open at the "sockets, and sodden the ground in their neighbourhood to a "dangerous extent."

Sanitary arrangements of Dwellings, Eassie, p. 22.

This may occur in laying drains in newly made ground, and it frequently does occur where the drain trench has been unevenly cut, and where inequalities of level are carelessly filled in with soft soil, which after a short time settles, and allows the joints to open.



T. P. T. Inv.

Joints gaping from sinking of foundation.

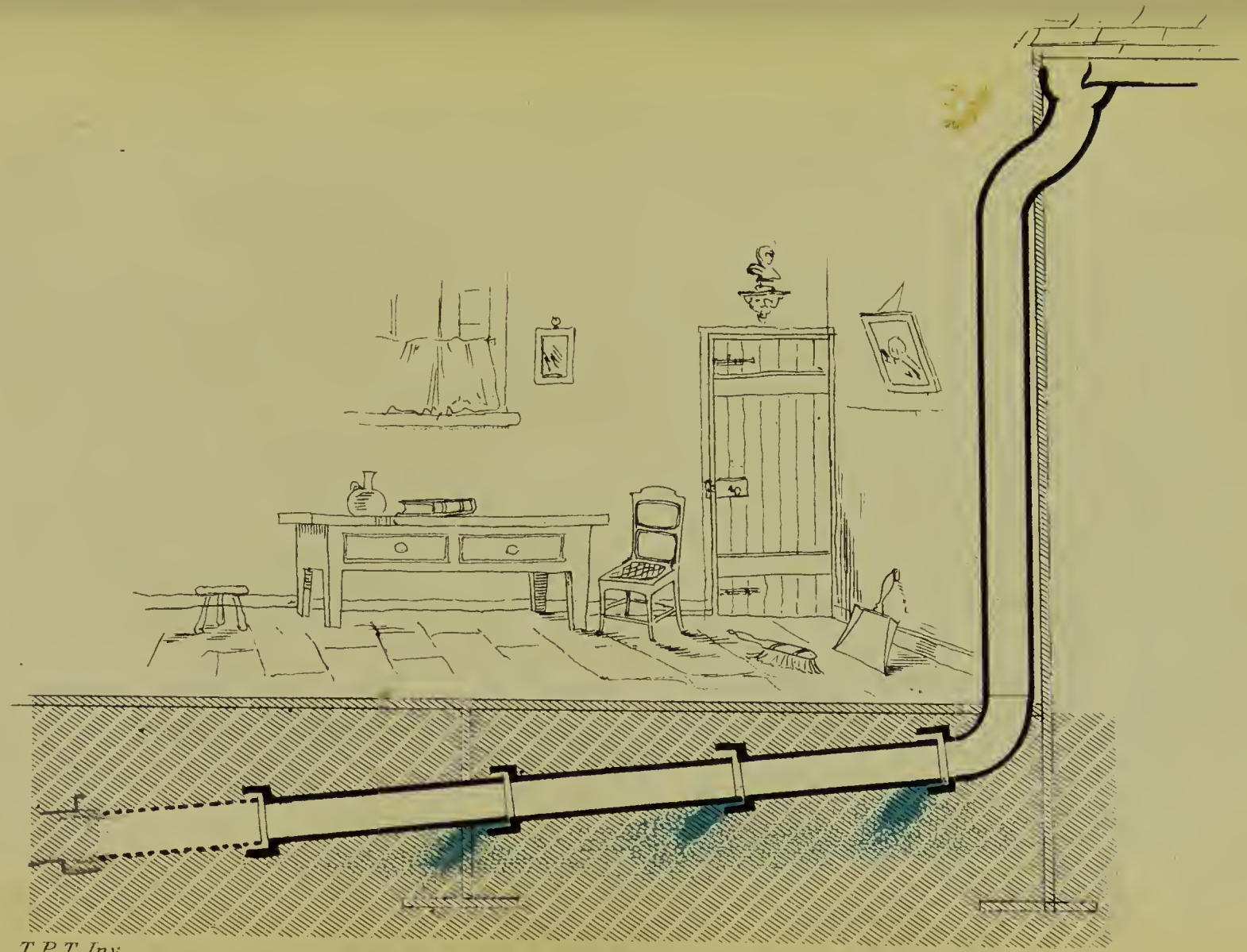
PLATE XL.

Pipes laid the wrong way.

This arrangement of pipes was discovered in our new Infirmary, by Mr. Chorley. Rain-fall pipes carried under a room, were leaking at each socket, rendering the soil damp.

This arrangement reduces very greatly the "water tightness" of the joints.

I have been told that builders in some parts of Yorkshire maintain that to place drain-pipes upside down is the correct way.



T.P.T. Inv.

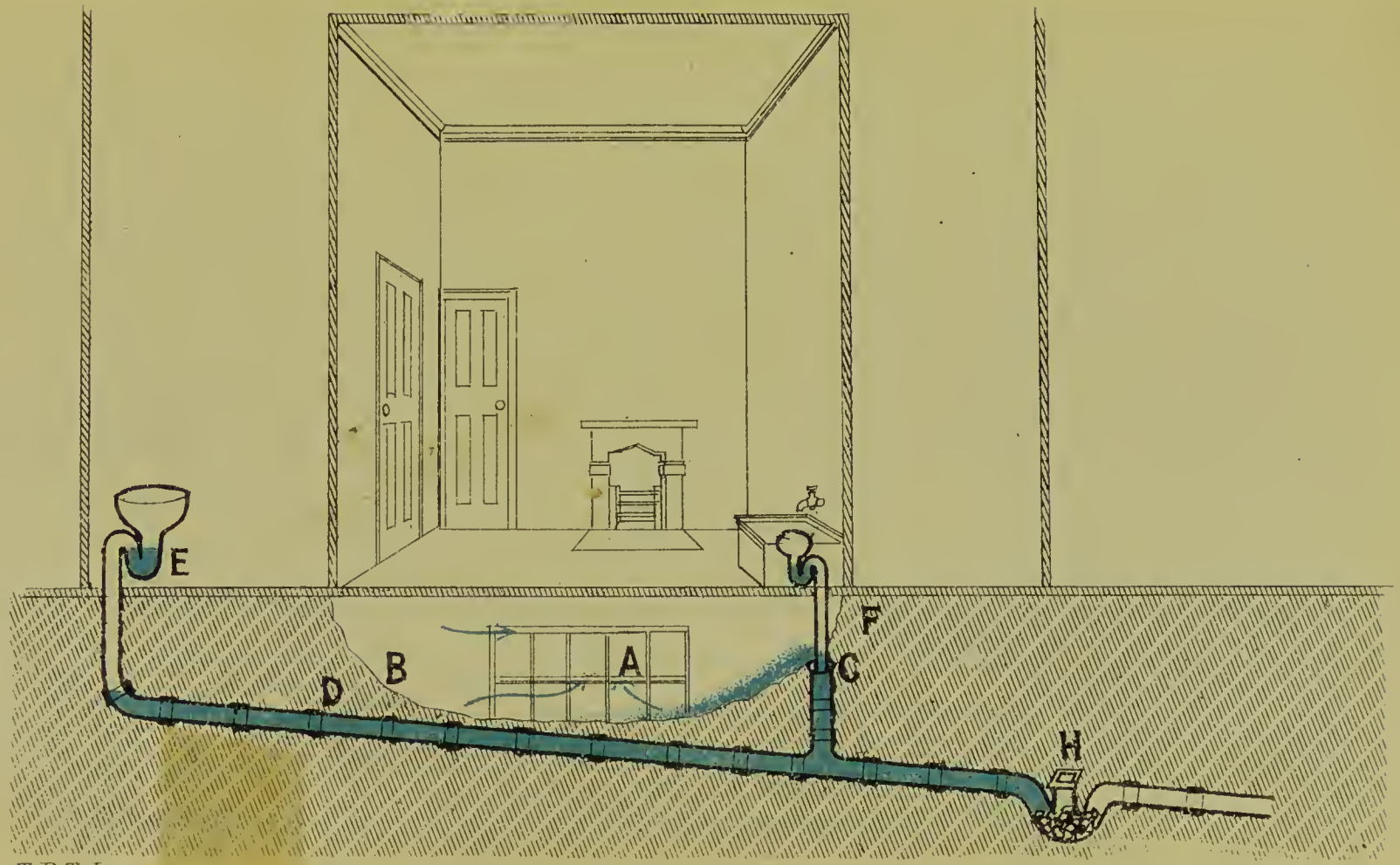
Pipes laid with the flange "down hill."

PLATE XLI.

Newly laid drain blocked by stones filling the syphon trap.

The facts expressed in the present Plate, and in Plates X. and XXV., were kindly communicated to me by Mr. E. Atkinson, Surgeon, of Leeds, in whose house they were detected. He gives me the following graphic description of the defects discovered :—

"Feb. 15th, 1877.—The house was occupied in June, 1876, "after being vacant two years, and in April, 1876, all drains "had been taken up and relaid, two new water-closets had "been constructed, the sewers had been trapped and ventilated "by means of pipes inserted on the near side of the traps, and "carried up to the house-top. Thus it was thought that all "had been done to secure health and comfort. At the end of "January, 1877, one of the new w.c.'s ceased to carry off the "sewage properly. Feb. 10th, the cook complained of such a "stench in the keeping cellar (A) that she could not go into "it without feeling sick. I found the area (B) outside the "larder window (A) with six-inches of sewage in it, and a "perforated zinc ventilator bringing the air over this sewage "to the meat and milk. Looking for the source of this, I "found a 6-inch vertical tube (C) just above the area, (being "a branch of the sewer (D,) into which the w.c. (E) "emptied itself,) ending abruptly, with a 1-inch waste-pipe "(F) from a lavatory leading into it, and without any attempt "having been made to make the junction good. From this open "end of a 6-inch tube, semi-solid sewage was welling over "into the area below in consequence of some obstruction in "the sewer. On inspection it was found that the syphon trap "(H) was blocked up with stones which had evidently fallen "in through carelessness when the trap was being laid. In "consequence the drain was stopped up in its entire length "by solid sewage, (nothing solid having by any possibility "passed the trap since it was first laid,) and was discharging "itself by regurgitation into the area of the larder."



T.P.T. Inv.

Newly-laid trap blocked with loose stones; back flow of sewage into area of larder window.

PLATE XLII.

Drain under a house running up-hill.

This illustration is contributed by Mr. Pickles, Surgeon, of Leeds. He had a slight scratch on the finger from which inflammation started and spread up the arm, due as he supposed to poison received in attending a patient. Soon after the recovery of the arm, he was again laid up with rheumatism of a low type. His medical attendant suggested that the house drain was probably the cause of the whole mischief. As soon as he was well enough he had his drains examined, and reported the result to me in the following note.

"I have had all my drain-pipes taken up and I find the "following defects:—

"The fall from the place where the soil-pipe enters the pot "drains is very defective, the level being higher in the centre "than at the termination.

"The drain-pipes themselves (six-inch pot drains) were full "of thick sewage matter, and had no luting or cement "between them. Lastly, at the very spot where the soil-pipe "is connected with the pot drain pipes, there is a broken and "defective 'pot.'"

The w.c. was at the back of the house, and the drain ran under a cellar kitchen, not, as in the drawing, immediately under the hall floor.

PLATE XLII.

T. P. T. Inv.

Drain under floor, with fall the wrong way. Broken pipe at the junction with fall pipe.

PLATE XLIII.

"To be continued in our next."

This example was also contributed to me by Dr. Britton, of Halifax, in the following note.

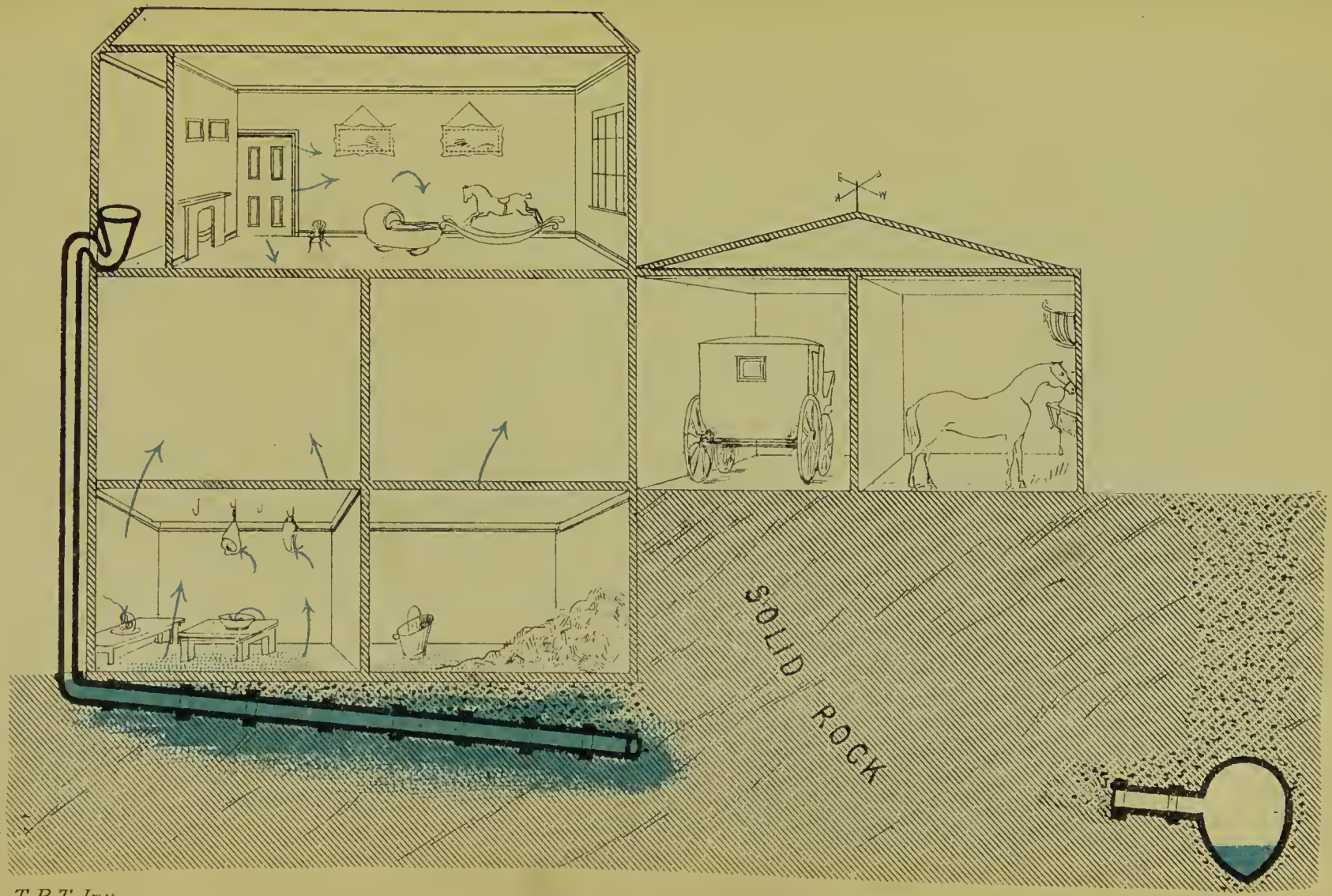
"In a gentleman's house the children were always ailing, "and in consequence I ordered an inspection of the soil-pipe "which was supposed to run under the house and some "outbuildings, and to join a main-drain in the road behind. "On the floor of the cellar and coal cellar being taken up, "there was found a very large quantity of sewage, which had "been accumulating *ever since the house had been built, seven "years before.*

"During the whole of this time all the sewage from the "w.c. had run under the floor of these cellars; for at the end "of the coal cellar the soil-pipe came to an abrupt conclusion "against a mass of solid rock, twelve yards thick, at the other "side of which a pipe was placed and connected with the "main-drain in the road. No doubt it was in order to save "the expense of blasting through the rock that the contractor "had scamped the work."

"The authorities saw the junction."

Until recently in Leeds, and probably in many a town besides, the following was the practice as to the inspection of sewers by the local authority. The Borough Inspector having received due notice from a builder of his intention to connect a house drain with a public sewer, came and "*saw the last pipe put in;*" with what security to the public may be judged from this Plate.

Nay more, a builder from a neighbouring town told me that by a judicious tip he could dispense with even this formality, if it were inconvenient to suit the time of the Inspector.



T.P.T. Inv.

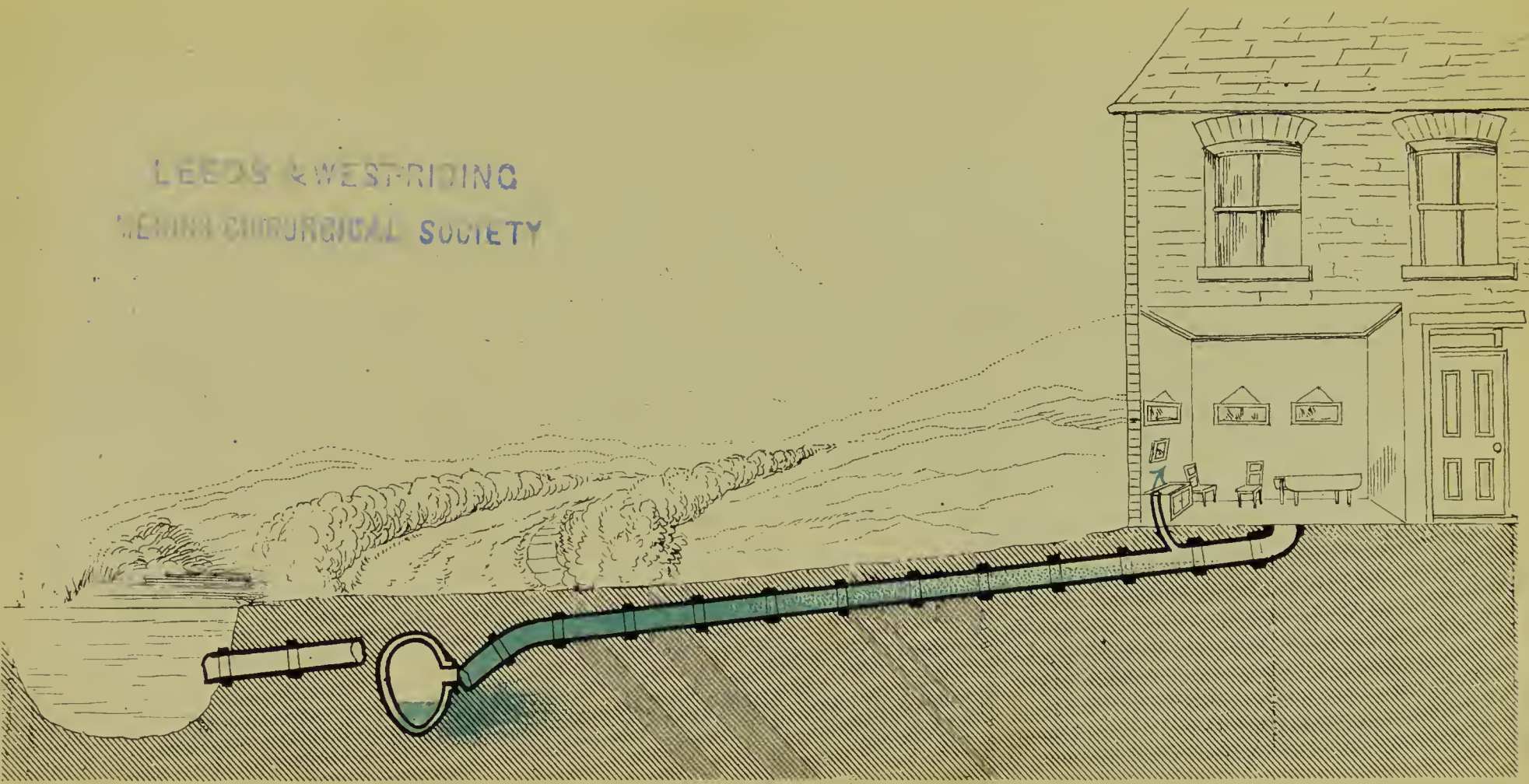
"To be continued in our next."—"The authorities saw the junction."

PLATE XLIV.

Disconnected and misconnected.

Mr. A. B., Town Clerk of the town of C., tells me that his house, situated 450 yards from the high road, was originally drained by nine-inch pipes into a pond a little beyond the high road. Early in 1876 the district was sewered, and the drain was cut off from the pond and connected with the main-sewer. In July, 1876, a maid and servant lad were seized with typhoid fever; the maid died and the lad recovered.

After the death, the drains were examined, and it was found (*a*) that waste-pipes from the kitchen, washhouse, pantry, and a lavatory, passed untrapped into the drains, with the scanty protection of a bell trap. (*b*) That the connection of the drain with the new sewer was so defective that the drain was blocked up at the junction, a nine-inch pipe having been inserted into an 18-inch pipe without any proper junction.



T.P.T. Inv.

Disconnected and misconnected.

PLATE XLV.

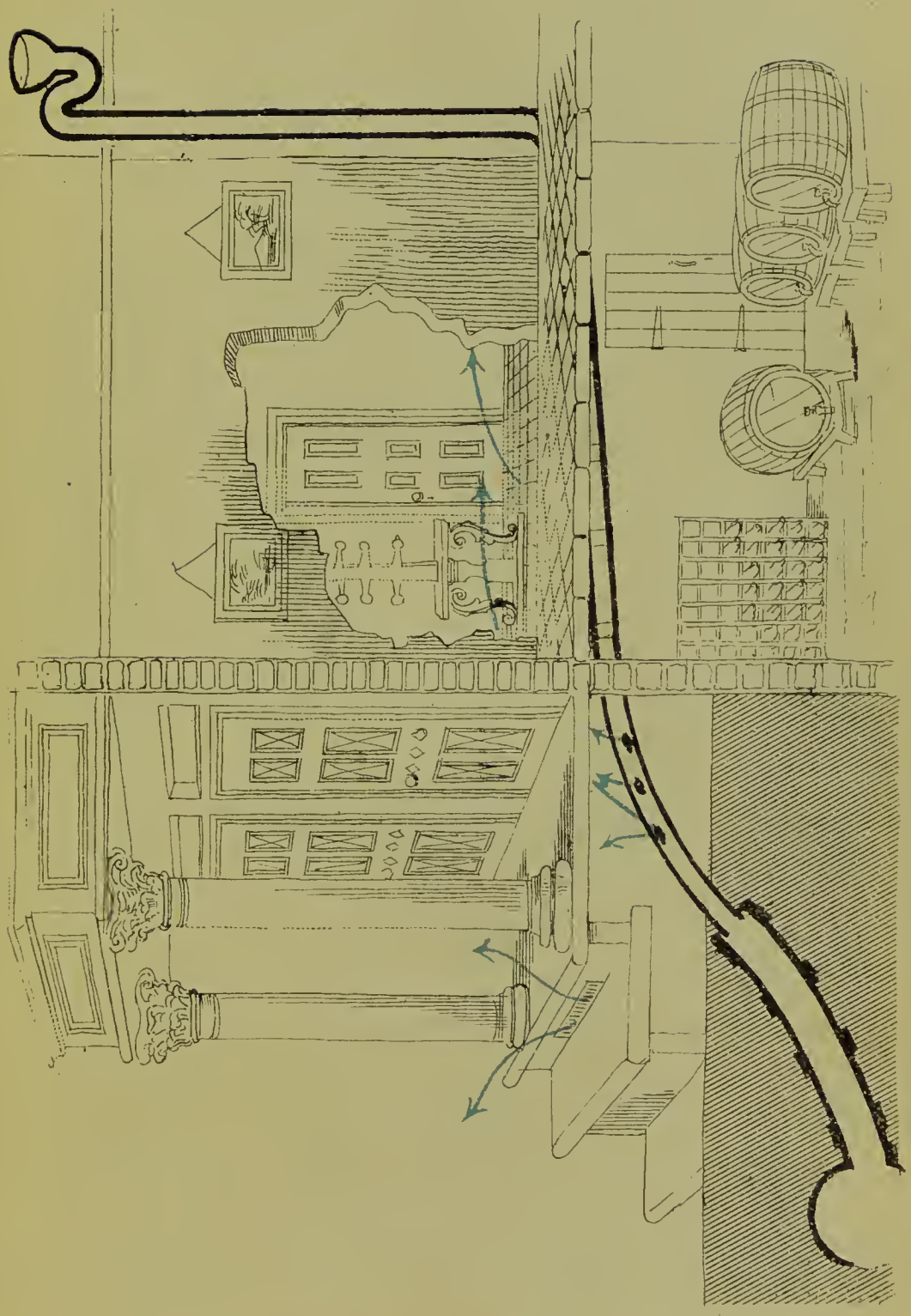
"Poisoned by next door neighbour's drains."

It is not easy to obtain an unexceptionable illustration of this danger. I feel convinced, however, that it does occur occasionally, either from leakage of drains soaking the party wall, or from a neighbour's soil-pipe running in the thickness of, or even on the inside of the party wall of the suffering house, or again from the *diffusion of sewer gases through the wall itself.*

The present instance was supplied by Mr. Hewetson. Having corrected every fault he could find in his house, (*vide* Plate XXIV.,) the house continued to be unhealthy, and did not lose the smell of drains until his next door neighbour had his own drains inspected, when the condition represented was discovered. The two houses had a common set of stone steps with a large chamber underneath. Through this chamber a soil-pipe with several openings in it passed to the drain, and from this chamber it would seem that foul gases were drawn into the hall of Mr. Hewetson's house. After the rectification of the flaws in the neighbour's soil-pipe, all trace of drain smell and drain illness disappeared from Mr. Hewetson's house. The neighbours had not suffered in health.

It is difficult enough to manage one's own drains, almost Utopian to hope to rectify the drains of one's neighbour.

PLATE XLV.



"Proximus ardet Ucalegon," Virg. Æn. II—311. Poisoned by next door neighbour's drains.

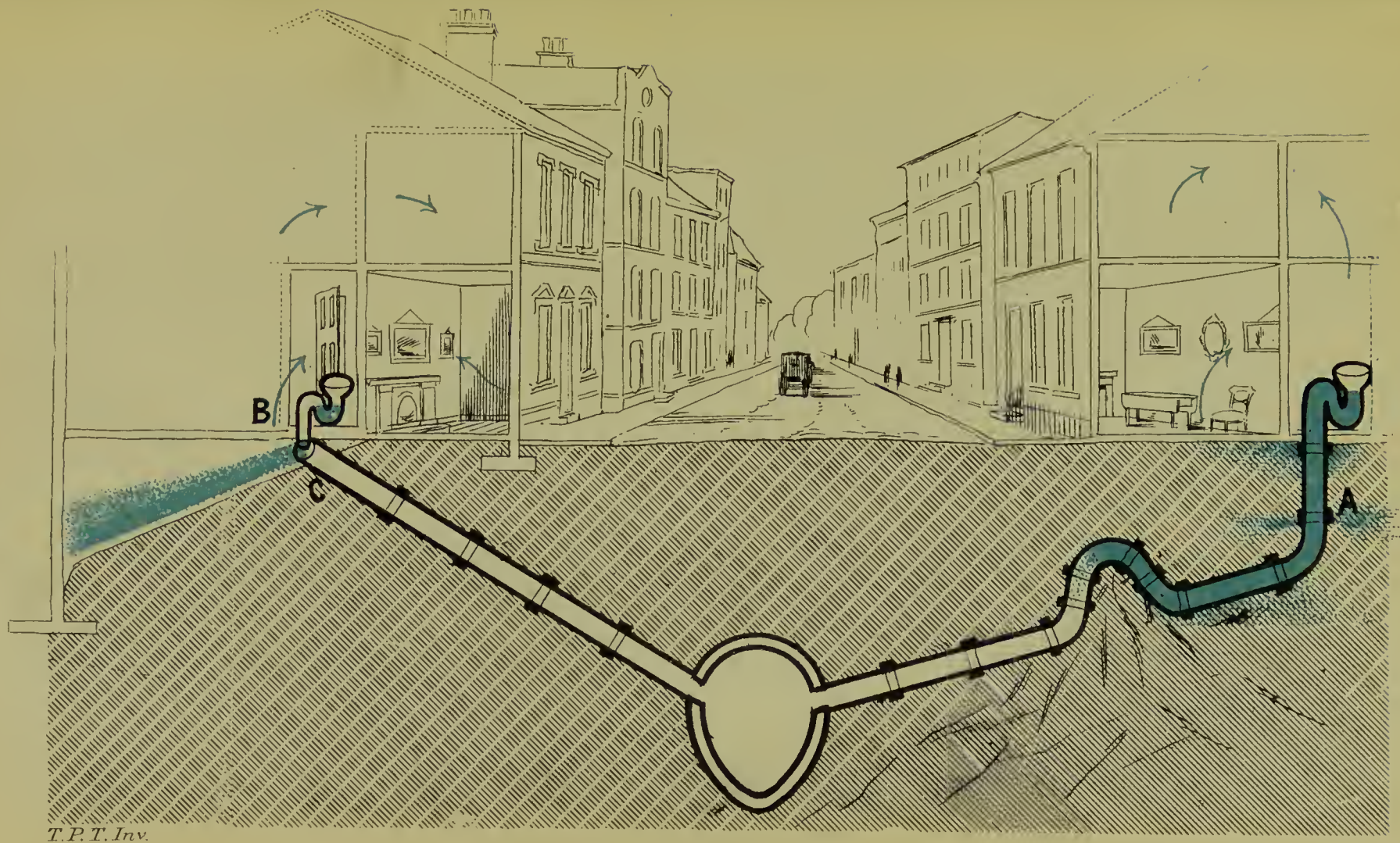
PLATE XLVI.

(A) Drain making the best of a rock.

The w.c. drain (A) is blocked as far as a rise in the drain, which was carried by curved tubes over the rock in order to avoid the trouble and expense of cutting through the rock. The fact expressed by this drawing, which looks like a caricature, was related to me by the landlord for whom the houses were built. Several builders who have seen the picture, have told me that they have seen drains so (mis) laid, and I know of one house in which this has been discovered to be the cause of obstructed drains since the publication of my lecture.

(B) w.c. discharging into the basement of a house.

The soil-pipe (B) missing the drain-pipe (C) had discharged the whole of the sewage into a triangular space below the ground floor. This went on for several months before the discovery of the defect was made, during which time "they never had the doctor out of the house."



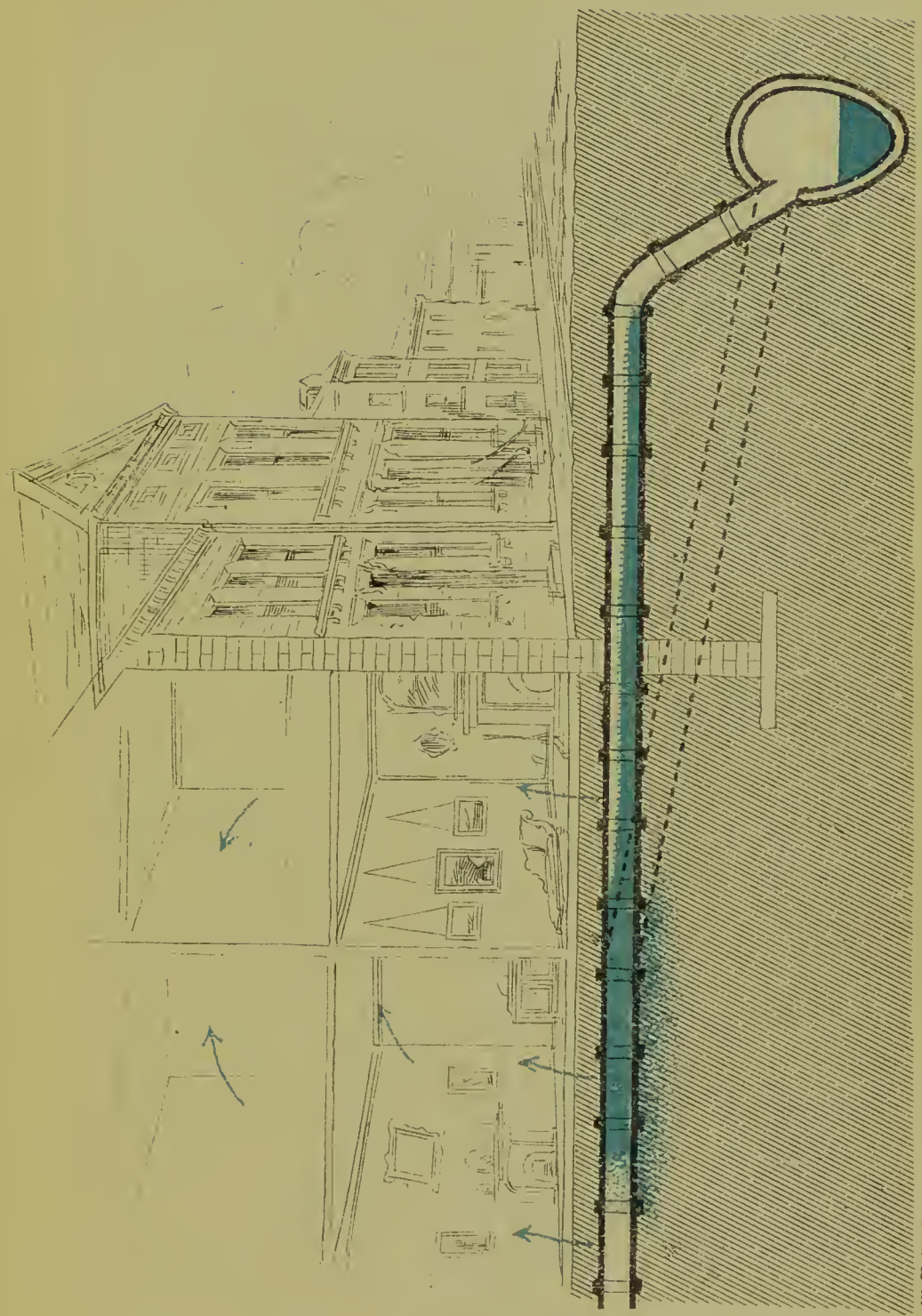
(B) w.c. discharging into basement of a house. (A) Drain "taking" a rock—sewage "refusing."

PLATE XLVII.

Economy in digging at the expense of "fall" in a drain.

This fact was related to me by a house agent and rent collector. A careless builder sometimes puts in the junction with a drain soon after commencing to build a house. When the time comes to lay the drain he finds that he has allowed far too little "fall." His duty would be to relay the drain and connection with the sewer with a proper incline. But this would cost money in excavation; so he saves his pocket, and leaves the drain to tell its own tale, when in due time the unlucky tenant finds his drains stopped, his house foul, his family ill, and the "tale told."

PLATE XLVII.



Economy in digging at the expense of fall in a drain.

T. P. T. Inv.

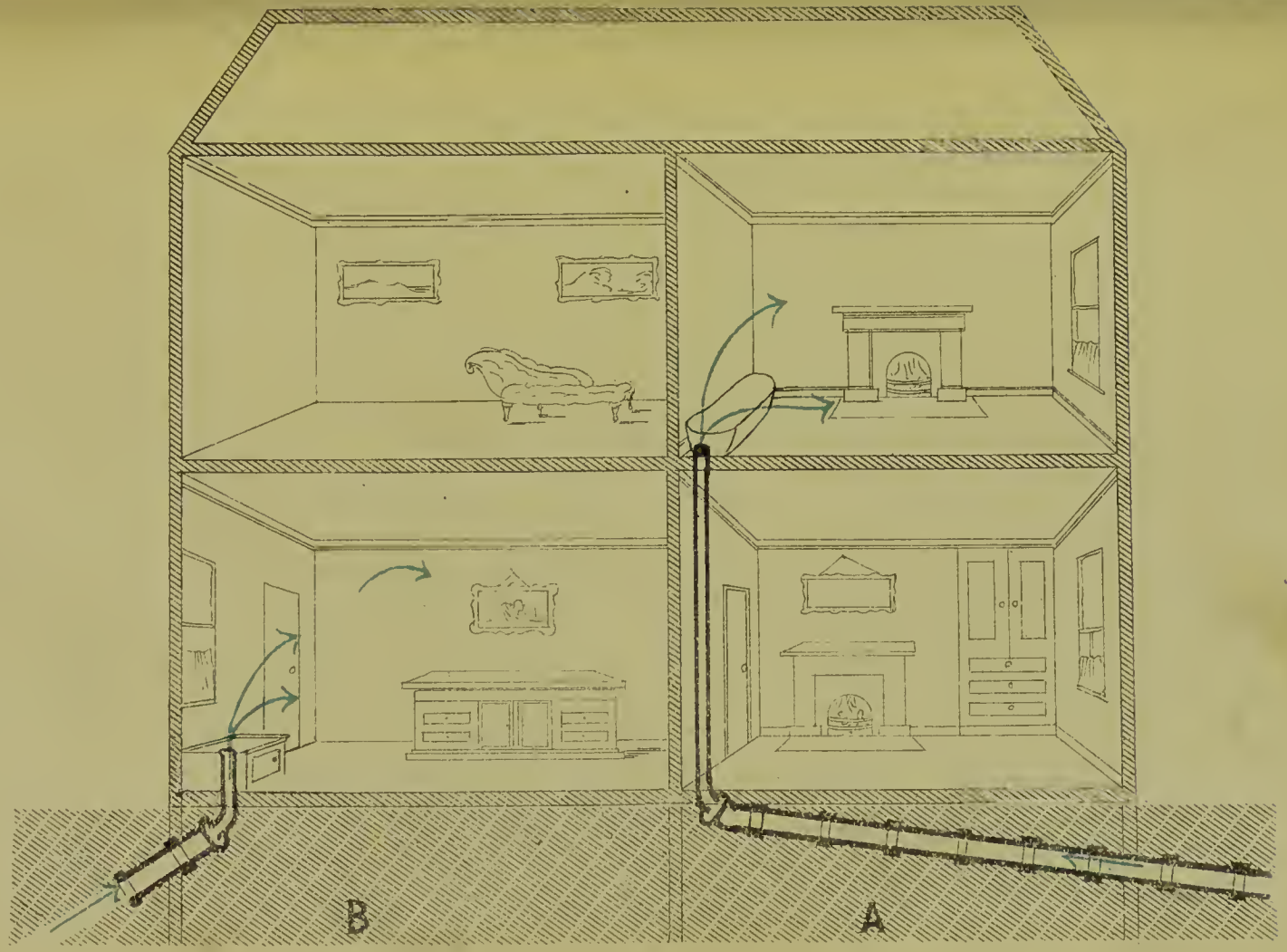
PLATE XLVIII.

Waste-pipe of bath and sink cut off—pipe open.

(A) was discovered in the following manner:—

Mrs. A., from Lancashire, came to spend a few days in Leeds. Soon after her arrival she consulted a medical man about a severe neuralgia of the face and side, and complained of a sore throat. The medical man on seeing her throat, at once enquired about her drains, but could not discover that any thing was wrong. In three days she reported herself as cured by the remedies prescribed. Her doctor thinking the cure too rapid to be the result of his medicine, again catechised her about her drains, and at last drew out that there had been a bath in a room near her bedroom, that the bath had been removed, but that the waste-pipe had been *left* (open of course) *in case they might wish to replace the bath.* The room had been constantly so unpleasant, that an apprentice who slept there had his window open summer and winter, and they had made many fruitless attempts to discover the cause.

(B) is taken from No. 20, Park Row, the house I formerly occupied. The scullery, on my leaving the house, was turned into an office, and the sink was removed. A few years after, the clerks complained of bad smells, and after much search the cut off waste-pipe of the sink was discovered underneath the floor boards open-mouthed, and passing direct into a drain.



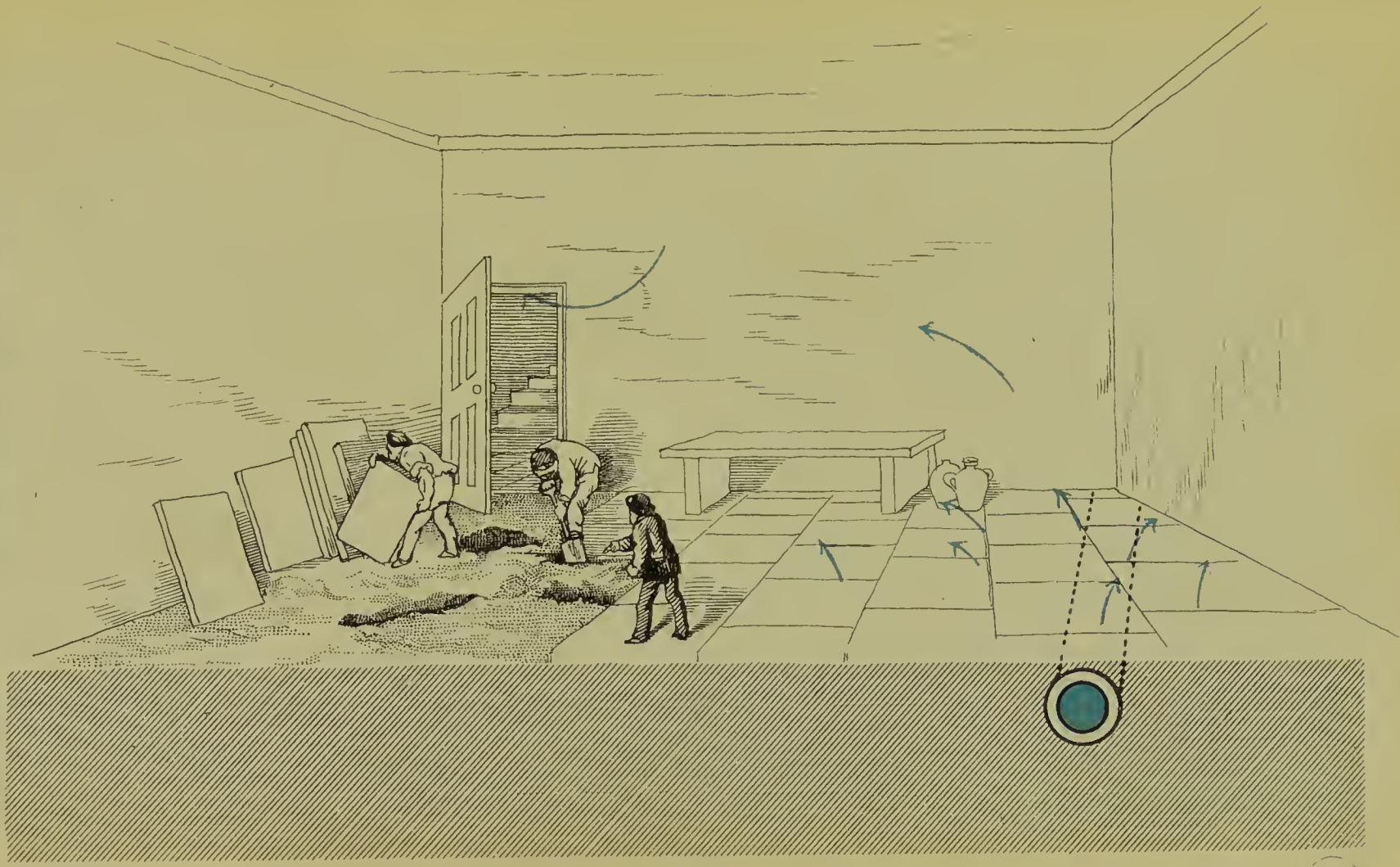
T.P.T. fec.

"A" bath waste-pipe cut off, and left open to the drain.—"B" sink waste-pipe ditto.

PLATE XLIX.

Hunting for Drains.—No Plans.

This plate is intended to enforce a *lesson* and to proclaim a *fact*. The *fact* is, that it is extremely rare for the owner of a house, still more rare for the tenant, to possess a plan of his drains. A house is built, and sold, and occupied, and after the lapse of a few months, or it may be a few years, the drains are blocked, and need examination, and no clue can be found to their whereabouts. The architect, perhaps, is dead, the builder a bankrupt, and the workmen are dispersed. The *lesson* is that every house ought to have attached to it a plan of the drains as a matter of right and law.



T. P. T. *Inv.*

"On the wrong scent."—No plans of the drains.

PLATE L.

Terrace of the Future on the Refuse of the Past.

This plate needs but few words. Until recently, no check has been put upon the haste of speculating builders, who have built thousands of houses on unhealthy rubbish heaps, long before the animal and vegetable refuse has had time to ferment, decompose, and cease to be poisonous. Within the last year, a plot of land, which served as the depot for the road scrapings of the Corporation of Leeds, has been covered with houses and shops. Such proceedings will surely be impossible in the future, thanks to the New Building Bye-Laws of our town. (§ 4), *Vide Appendix.*

"Terrace of the future on refuse of the past."

PLATE L.

PLATE LI.

Arsenical Wall Papers.

This danger cannot well be expressed in a drawing. In order, however, to keep to the fundamental principle of the book, viz., to appeal to the eye in order to enforce every lesson, this plate is given as expressing the fact of arsenical paper being stripped off a wall.

Much has been written in medical and lay journals of the injury to health inflicted by arsenic in wall papers. During the last two years I have traced ailments to this cause in several instances, and I keep, as trophies, pieces of the detected and condemned papers.

About five years ago, my own children were unwell from sleeping in a newly-papered bedroom. The paper had a brilliant green pattern, and was guaranteed "free from arsenic." The illness of one child after another led me to have the paper examined by my friend, Mr. Scattergood, and he reported the paper full of arsenic in a loose and dangerous form. The paper-hanger was dismayed, replaced the paper, and, I believe, no longer takes "warranted" papers on trust.

The following has also been told to me: Firstly, that almost all colours used in paper staining may contain arsenic, and that arsenic is used very extensively; Secondly, that one of the leading paper makers of this district is now turning out *all* his papers entirely free from arsenic.

Akin to this subject is the filthy custom of placing a new paper on a wall without stripping off the old one—of which the following illustration has been related to me:—

An officer, occupying a room in the old Knightsbridge Barracks, suffered from ill health, headache, and loss of appetite. He went away, and rapidly recovered. One or two others occupied the room after him, became ill, and left. The cause of the illness was searched for in drains, ventilation, and water, but in vain. At last the room had to be "done up," and it was found to be covered by a series of wall papers, one over the other, and that colonies of "maggots?" were feeding on the accumulated layers of paste and paper.

PLATE LI.

Stripping poisonous wall papers.

PLATE LII.

"Window Ventilator" in the Roof of a Brougham.

Having, during the last eight or nine years, derived much comfort from the window ventilator, I wish to publish this for the benefit, more especially, of my medical brethren. As many of them spend a great part of their life inside a carriage, it is for them highly important :—Firstly, that they should breathe as pure an air as possible, and that without the infliction of a draught. Secondly, that they should be able to read with the best light attainable, a roof light, and avoid the distressing variations of the side light in passing through the streets.

The idea of a roof light was suggested to me by my friend Mr. R. P. Oglesby. On giving instructions for the roof light to the carriage builder, Mr. Bradley, of Leeds, he suggested that the window should be on a hinge, and should open backwards, and thus supply ventilation. The result exceeded my expectations. The following points must be attended to in its construction :—

The *size* of the window should be about 18 inches by 8.

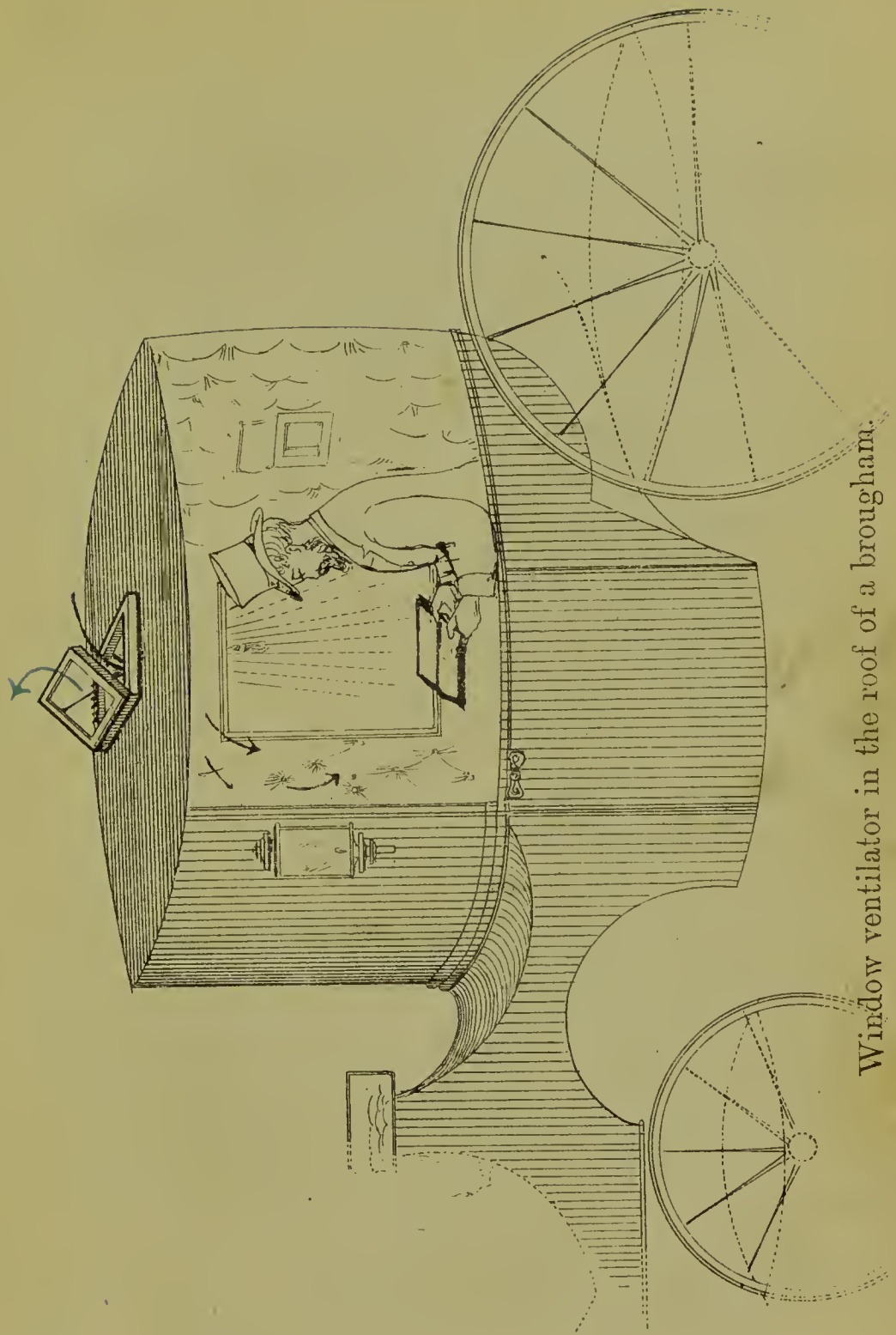
The *position* should be vertically over the place in which the book is held, *i.e.*, over the knees. This is important for three reasons—the first, that it is the best position for illuminating the book ; the second, that if there should be a strong wind from the rear, no draught can come upon the head ; the third, that if during rain an occasional drop of water enters, it will not fall on the cushion, but upon the floor, or a rug on the knee.

The *elevation* is secured by a small rack and prop.

The *closure*, (very rarely needed,) is important. If it be fixed *closely down*, the vibration sucks in water during rain, and causes dripping. This is avoided if the hook fastener fixes it one-sixth of an inch open.

In winter the air of the brougham remains quite fresh, even with three persons, without the need of opening any side windows. The following experiment is interesting :—Travelling one frosty day with two companions, and observing the windows of other carriages dull with "steam," whilst my own were clear, I closed the roof ventilator, and in *five minutes* the whole of the windows were covered with steam. The ventilator was then opened, and in five minutes more three-fourths of the windows were clear.

PLATE LII.



Window ventilator in the roof of a brougham.

May not much of the delicacy of hard worked medical men be caused by their breathing in their carriages a deteriorated air, with the alternative of draughts, which their enfeebled health can ill endure? May not such a ventilator enable them to throw away their respirator?

Five medical men in Leeds have adopted the roof ventilator.

PLATE LIII.

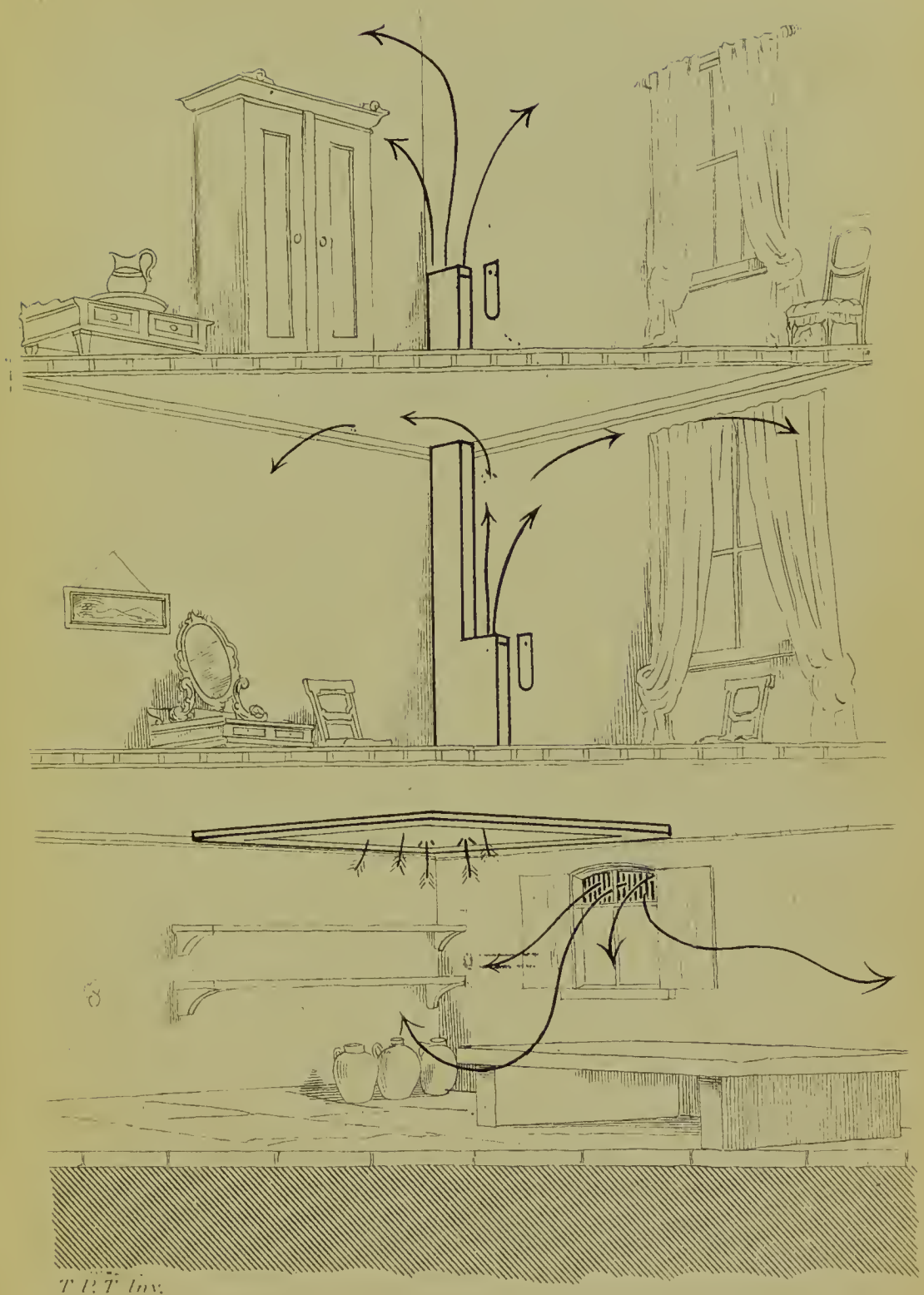
Admission of Fresh Air and Exclusion of Dirt.—No. 1.

It is with some diffidence that I venture to offer remarks on ventilation, and in doing so I must appeal to the words of the introduction, that any suggestions are intended as a "standard *below which* ventilation ought not to fall."

Without entering on a discussion of the merits of various plans proposed for admitting fresh air into rooms, I will state what has been done in a house of my own, specially fitted for the use of invalids, and my views of the results arrived at. Bearing in mind the teaching of Plate III., that the chimney has to be supplied with air, a Tobin's tube, with a sectional area about equal to the chimney pot, was placed in each room. The effect of this is that the rooms are constantly fresh night and day, that irregular draughts are much reduced, and that, except in cold weather (an outside temperature approaching 32°), the ventilators are rarely closed. That this should be accomplished without any draught would be too much to expect, but that most persons can endure the currents produced, especially when they become accustomed to the greater freshness of the air, is beyond question.

Having secured for each room its own supply of air for the chimney, the next question was, how to clean the air, and exclude the dirt. I had long seen that, if air is to pass through a screen without retardation of the current entering the room through the tube, the area of the screen must be many times, (perhaps 15 or 20 times) the area of the section of the tube. At this point an idea was suggested, and worked out for me by Mr. Frederick Bapty, of Leeds, and Mr. James Bapty, of Bombay. The Tobin's tube was carried through the floor of the room, so as to open in the ceiling of the cellar beneath. This opening was covered by a screen of bunting, about 4 feet square, fixed to the ceiling of the cellar so *that all the air passing up the Tobin's tube from the*

PLATE LIII.



Ventilation without dirt—No. 1.

cellar must traverse the bunting. Ample arrangements were made at the cellar window for the entrance of air to supply the screen. The general result was as follows:—Air readily entered the cellar, which had been made safe against sewer gas, and having deposited the coarse dirt and soot, ascended through the screen in the ceiling to supply the room above. Were I to build a house in a town, I would have a screening chamber in the basement, whence tubes should be carried in the walls, like chimneys, to deliver a stream of cleansed, and, perhaps, warmed air, to every room. I have no doubt that a stream of fresh cleansed air could be delivered in a room without producing a draught, by means of a perforated tube passing round a room about 2 feet below the cornice. But such a tube *must be planned with scientific accuracy, as to the effect of friction on the speed of the current at every point.* The simpler plan would be to warm the air in the screening chamber, and then the draught from the Tobin's tube would not be felt.

PLATE LIV.

Admission of Fresh Air, and Exclusion of Dirt.—No. 2.

Having fitted five rooms with Tobin's tubes, supplied with sereened air from the cellar, my efforts were then directed to screen the air admitted to a Tobin's tube, directly through the outer wall. I therefore showed my cellar screens to Messrs. Harding, agents in Leeds for Tobin's tubes, and requested them to place the screen, if possible, in the tube itself, telling them that the screen must be at least 10 times the area of the section of the tube, and that the section of the tube must equal the section of the chimney pot. Mr. Joseph Harding very shortly hit upon the happy idea of placing the screen in the tube diagonally, from top to bottom, and thus achieved what I was seeking.

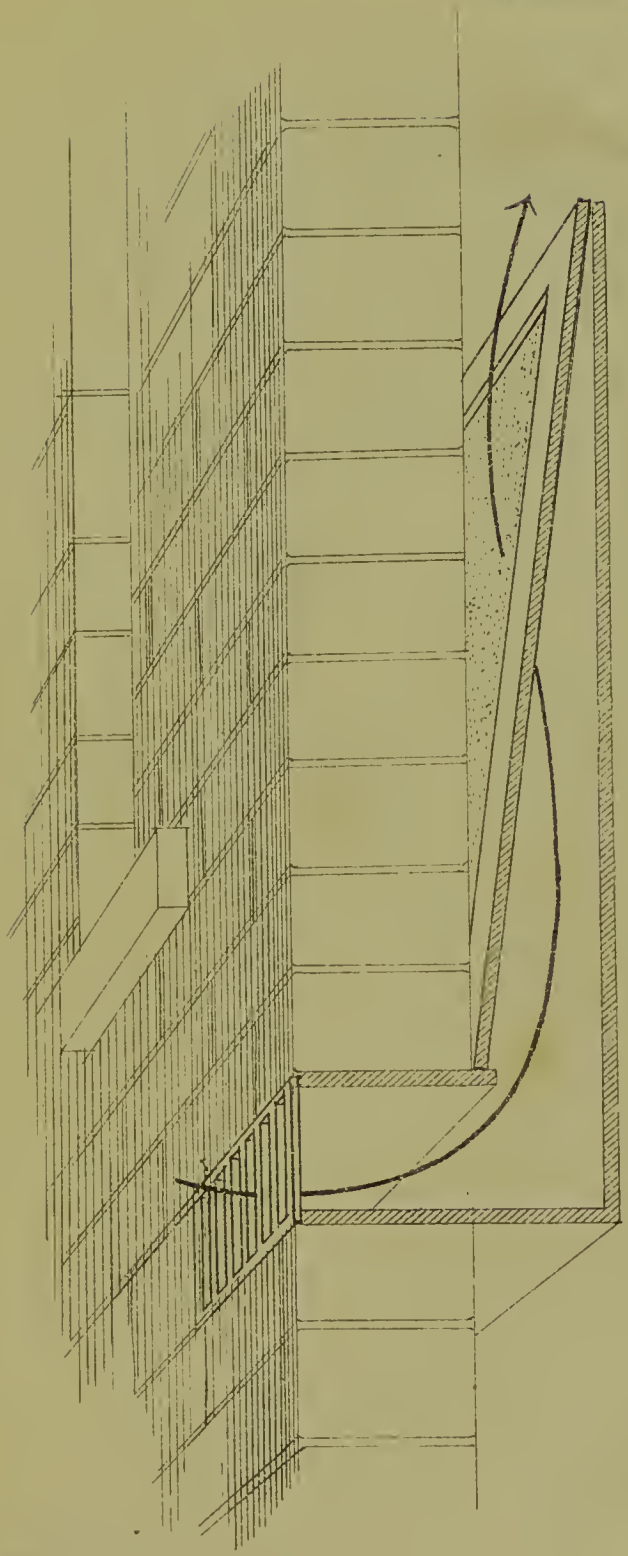
(A) is the grate in the outer wall, to keep out birds and mice. This grate must not "throttle" the air, *i.e.*, must not admit less air than the tube it has to supply.

(B) is the screen covered with canvas or bunting. It slides in grooves, and is removed twice a week that it may be brushed.

(C) is a door to allow accumulation of dust to be removed from the bottom of the tube.

The current of air is shut off or diminished by pieces of wood which slide over the *top* (*Vide* Plate LIII.), and hang

PLATE LIV.



T. P. T. Inv.

Ventilation without dirt—No. 2.

at the side when not in use. The value of these tubes and screens is very great, and in proportion as they effect their purpose by supplying the chimney draught, and by preventing irregular currents from the windows and doors, do they render *a room in a town as cleanly as a room in the country.*

PLATE LV.

Why Glass Cases don't Exclude Dust, and how to make them do so.

Dust is the ruin of collections in museums, and a perpetual source of most annoying expense. It is a discredit to science that we have not conquered such an extravagant enemy, and yet I feel sure that the remedy is a simple one, if we will but ask ourselves the question: why does dust always enter the most carefully made glass cases?

The answer is clear. The air inside the case is constantly altering in volume, under changes of temperature, and changes of barometric pressure. This perpetual variation causes the entrance of perpetual currents of dirt-laden air through minute crevices. What, then, should be done? First and foremost, the fact must be acknowledged, and a sufficient air channel made, so that (as in Plate III) the air may enter by the "legitimate" channel, and the "irregular" channels may cease to act; next, the "legitimate" channel must screen the air. For achieving this let me venture to make several suggestions. I must, however, apologise for publishing in print suggestions which have not yet been practically tested. My reason for doing so is that I may anticipate patentees, and, if there be anything of value in any of my suggestions, that they may be rescued from the stifling atmosphere of the Patent Office for the benefit of the public:—

Suggestion A.—This is an inverted square tube, of a section 4 inches square, attached to the side of a glass case in the Museum of the Leeds Philosophical and Literary Society. The mouth of the tube is filled with *lightly*-packed cotton wool. In a few months the outer part of the wool was blackened with dust. Such a tube, however, is probably far too small.

Suggestion B.—That one or both ends of a glass case be closed with wire, for safety, and the wire covered with baize or bunting, which would admit the air and exclude the dirt.

Suggestion C.—This, if it would act, would be the most scientific, most self-acting, and most perfect. It is based on

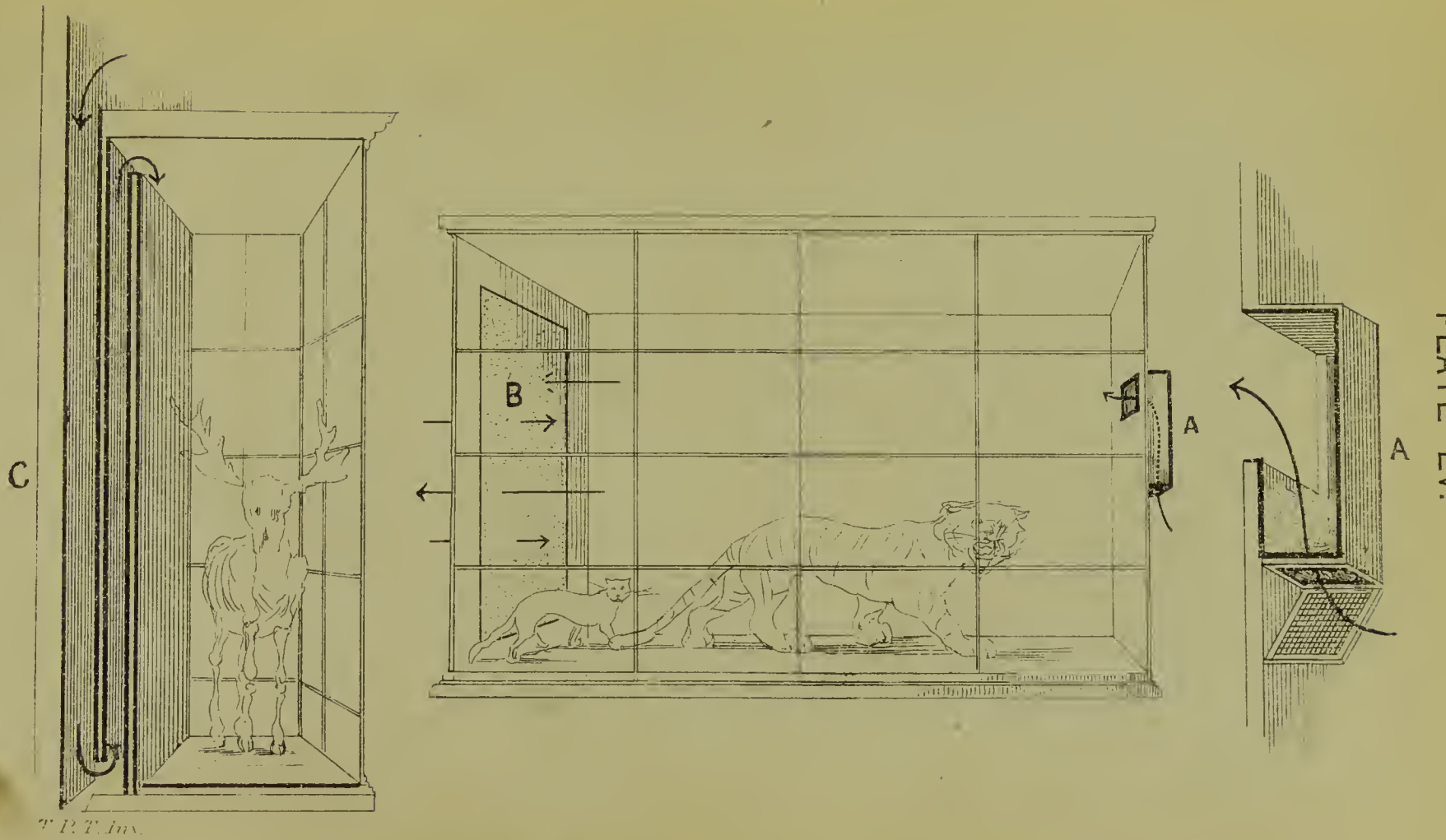


PLATE LV.

Dust, the ruin of museums. Why not keep it out?

a suggestion of Dr. Eddison, of Leeds:—Having ascertained from Professor Rücker that the volume of air in a case will vary in volume about one-tenth, it occurred to me that the back of a glass case might be made double, the distance between the two backs being equal to one-tenth of the depth of the case from front to back. Then if the "inner back" stopped short of the top of the case by two inches, and the "outer back" stopped short of the floor by two inches, there would be free ingress and egress of air between the interior of the case and the space within the double back, but the outer dirt-carrying air would never directly reach the interior.

APPENDIX I.

The necessity of going to press compels me in the present edition to omit some important defects, such as the following:—

1.—Addition to a house built over a cesspool or badly-constructed drain.

2.—Farm cottages and wells as part of a farm yard ("fold yard") many feet deep in manure, liquid, and solid.

3.—The condition of drains discovered in the new workhouse at Halifax, drains running up-hill, and much scamped work communicated to me by Dr. Dolan, surgeon to the workhouse.

4.—Curves made by straight pipes instead of a proper bend, and therefore open at every joint.

5.—Drains of one house running up-hill under the next house, leaking into neighbour's cellar, and causing illness; contributed by Mr. Collier, surgeon, Ripon.

6.—A butler angling for rats in a tank under a house; contributed by Mr. John Horsfall as a fact about his own house previous to his ownership.

7.—An instance related to me by Dr. Clifford Allbutt of a suburban vicarage in which illness occurred, which was caused by obstructed drains. The Corporation were laying a new main sewer, deeper than the old one, and the workmen, in removing the old drain, had cut off and sealed up the vicarage drain.

APPENDIX II.

Extracts from bye-laws with respect to new streets and buildings, issued by the Council of the Borough of Leeds, and allowed by the Local Government Board, July 12, 1870 :—

§ 4. No person shall construct any foundation of a new building on a site which has been previously used as a place for depositing night soil, refuse, or any offensive material which may have rendered such site liable to cause buildings erected thereon to be unhealthy, until such refuse or offensive material shall have been removed to the satisfaction of the Corporation, and such site shall not be built upon until the same shall have been approved by the Corporation.

§ 33. The person erecting any new building shall, as regards the construction of the drains of such building, comply with the requirements hereinafter specified, namely :—

(*a*.) He shall cause such building to be provided with sufficient drains to carry away the whole of the waste water and drainage from such building, and with suitable and sufficient spouts and fall pipes for conveying the rain water from the roof of such building to the drains.

(*b*) He shall construct the lowest story of such building at such a level as will allow of the construction of a sufficient drain from such building with an adequate fall in such drain, and so that such drain shall communicate with any sewer into which it may discharge, at a point in the upper half section of such sewer.

(*c*.) If there be no sewer within a distance of 100 feet from such building, he shall cause the drains to be taken to a cesspool properly constructed in accordance with these Bye-Laws.

(*d.*) He shall cause the drains of such building to be constructed of good glazed stoneware pipes or pipes of other equally suitable material; to be not less than 6 inches diameter for waste water and water-closet drains, and of not less than four inches diameter for rain water drains, to be laid with a proper fall and with water tight socketted or other suitable joints.

(*e.*) He shall cause the lowest cellar, or basement storey to be provided with a suitable and sufficient drain for the effectual drainage thereof.

(*f.*) He shall not construct any drain so as to pass under any building, except in any case where any other mode of construction may be impracticable, and in that case he shall cause such drain to be laid in the ground at such a depth that there shall be in every part a distance equal at the least to the full diameter of the drain, between the top of such drain and the finished surface of the ground, and he shall cause such drain to be laid in a direct line for the whole distance beneath such building and to be embedded in and surrounded with good and solid concrete at least 6 inches thick all round.

(*g.*) He shall in the case of any back to back house, which is unprovided with any open space appurtenant thereto, cause the inlet to the drain or drains from such house to be at a point, as near as may be practicable to any external wall of such house, and he shall cause such inlet to be provided with a suitable trap.

He shall cause every pipe for conveying waste water from such house to the drain, to discharge immediately into the trap.

He shall also cause such waste pipe to be of lead or iron, and of not less than two inches diameter interior measurement.

(*h.*) He shall not construct in the drains any right angled junction, whether vertical or horizontal, but he shall cause every branch or tributary drain to join another drain obliquely in the direction of the flow of such drain.

(*i.*) He shall not allow any inlet to any drain to be made within any building, except such inlet as may be necessary from the apparatus of any water-closet, and he shall cause the waste pipe from every sink, bath, or lavatory, the overflow pipe from any cistern and every pipe for carrying off waste water, to be furnished with a syphon trap, and to be taken through an external wall of such building and to discharge in the open air over a channel leading to a trapped gulley grating. Provided that the requirements of this clause shall not apply in the case of any back to back house, which is unprovided with any open space appurtenant thereto.

(*j.*) He shall in every case, cause the drains to be furnished with a shaft from the exterior drain, not less than two inches and a half in diameter, communicating with the outer air above the eaves spouts.

(*k.*) He shall cause the drains to be efficiently trapped at some point near to their outfall, and he shall cause suitable and sufficient means of ventilation to be provided in such drains. He shall also cause every inlet to such drains, except such as may be provided for the ventilation thereof, to be properly trapped.

§ 34. Before commencing the erection of a new building in any street, the Owner or Builder shall, if there be a main sewer or drain within 100 feet of the site of such new building, make a connecting drain or sewer from such site to such main sewer or drain at such a depth as to carry off from the lowest excavations for a basement of such new building all the water capable of being carried off by such sewer or drain, and shall thereby or otherwise prevent such water from flowing into the basement of cellars of any adjoining or neighbouring buildings or into the walls thereof.

§ 35. No person shall construct a Cesspool in any case where an accessible outlet sewer is situated within 100 feet from the dwelling-house or building to be drained.

§ 36. Every person who shall construct a Cesspool in connection with a building shall construct such Cesspool at a distance of 15 feet at the least from a dwelling-house or public building,

or any building in which any person may be, or may be intended to be employed in any manufacture, trade, or business.

§ 37. A person who shall construct a Cesspool in connection with a building shall not construct such Cesspool within the distance of 18 feet from any water supplied for use, or used, or likely to be used by man for drinking or domestic purposes, or for manufacturing drinks for the use of man, or otherwise in such a position as to endanger the pollution of any such water. Provided always that the foregoing requirements shall not apply where such water is supplied by the Corporation and conveyed in metal pipes.

§ 38. Every person who shall construct a Cesspool in connection with a building, shall construct such Cesspool in such a manner and in such a position as to afford ready means of access to such Cesspool, for the purpose of cleansing such Cesspool and of removing the contents thereof, and in such a manner and in such a position as to admit of the contents of such Cesspool being removed therefrom, and from the premises to which such Cesspool may belong without being carried through any dwelling-house or public building, or any building in which any person may be or may be intended to be employed in any manufacture, trade, or business.

He shall not in any case construct such Cesspool so that it shall have, by drain or otherwise, any outlet into or means of communication with any sewer.

§ 39. Every person who shall construct a Cesspool in connection with a building, shall construct such Cesspool of good brickwork in cement properly rendered inside with cement, and with a backing of at least 9 inches of well puddled clay around and beneath such brickwork.

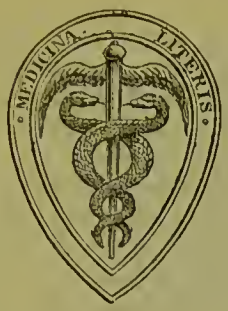
He shall also cause such Cesspool to be arched or otherwise properly covered over, and to be provided with adequate means of ventilation.

§ 40. Every person who shall construct a Water-closet or Earth-closet in a building shall construct such Water-closet or Earth-closet in such a position that that one of its sides, at the least, shall be an external wall.

§ 53. Every person who shall construct a water-closet in connection with a building used or intended to be used as a dwelling-house or shop, shall cause such water-closet to be provided with a 4-inch internal diameter soil pipe of lead or iron, which shall be continued upwards without diminution of its diameter and (except where unavoidable) without any bend or angle being formed in such soil pipe to such a height, and in such a position as to afford, by means of the open end of such soil pipe, a safe outlet for sewer air.

§ 58. Every person who shall intend to let for occupation, or being the owner thereof, shall occupy as a dwelling-house any new building of which the rateable value is under £20, shall give seven clear days' notice thereof to the Corporation. Such notice shall not be given until the building is actually completed, and shall be delivered at the office of the Building Inspector of the Sanitary Authority, at Leeds, and such building shall not be occupied as a dwelling-house until the drainage thereof has been made and completed, or until such building has after examination been certified by the surveyor to be fit for human habitation, and the surveyor shall give a certificate to that effect if he is satisfied after examination that such building is fit for human habitation.

§ 65. Such person shall also, before proceeding to cover up any sewer or drain, or any foundation of a Building, deliver or send, or cause to be delivered or sent to the said Surveyors, two days' notice in writing, in which shall be specified the date on which such person will proceed to cover up such sewer, drain, or foundation.



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February, 1879.

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